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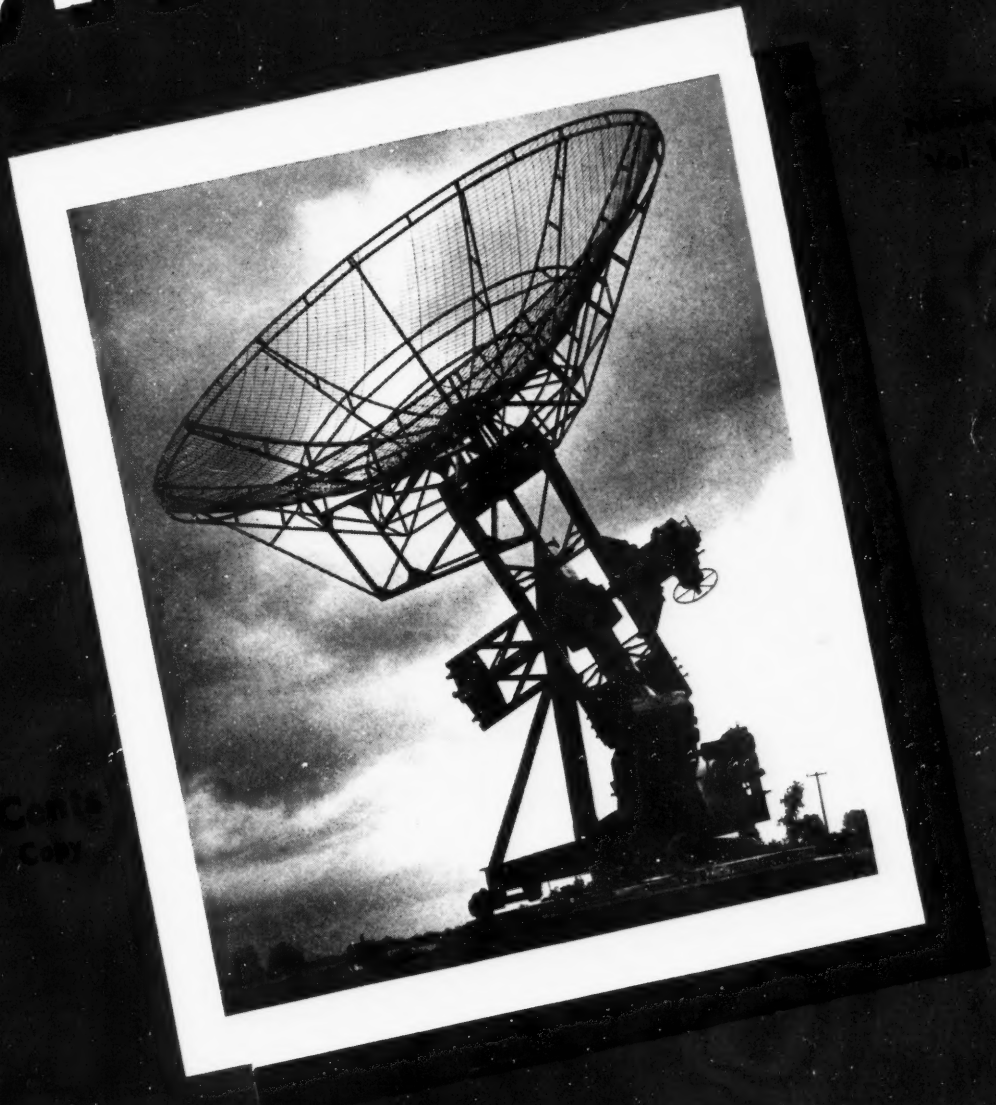
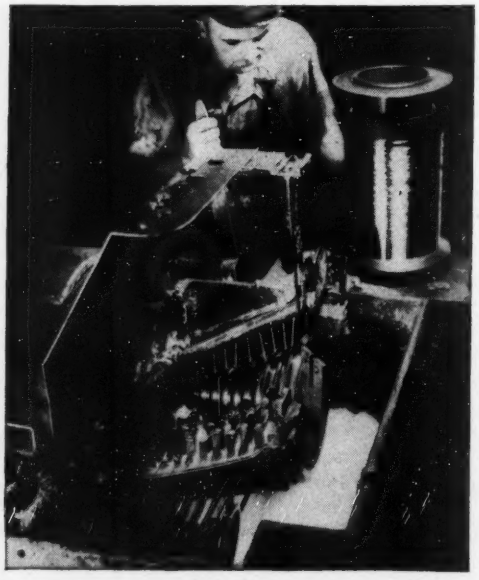


COLLEGE OF ENGINEERING · CORNELL UNIVERSITY

SUPER TENSILE MUSIC WIRE PLATED WITH PURE GOLD...

developed by American Steel and Wire Company

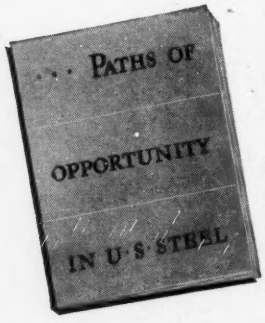
Tenor banjo and tenor guitar players have long been plagued by unsatisfactory "A" or first strings. This string, when properly tuned, is under such high strain that most wires barely reach pitch. At the request of the Mapes Piano String Company, the Metallurgical Department of the Worcester Works of the American Steel and Wire Company, a subsidiary of United States Steel, created, after months of research, a wire specifically for this purpose. This new wire is made so strong that it possesses more than twice the tensile strength, in pounds per square inch, of cross sectional area, of the steel wire which American Steel and Wire spun into cables to suspend the 8¼ mile bridge across San Francisco Bay from San Francisco to Oakland, California. This makes the new string the strongest wire of its size of any kind known today.



This high quality super tensile wire is produced by a special combination of heat treatments and exceptionally long and exacting cold working. The result is a wire of 0.010 gauge with a tensile strength of approximately 460,000 pounds per square inch. One pound of this wire extends 3749 feet, or sufficient footage to pass from nut to bridge on approximately 1500 banjos or guitars. This unusual wire is then plated with pure gold in order to prevent rust and to impart beautiful appearance.

Opportunities

This wire development is typical of the work being done in United States Steel Laboratories. But such research is only one kind of development to be found within the United States Steel industrial family. United States Steel and the steel industry are famous for development of men.



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The CORNELL ENGINEER

Volume 14 Number 2

CONTENTS

Cover: Radio telescope with 17-foot parabolic reflector being assembled near the East Hill Airport for the Radio Astronomy Project at Cornell. Designed to withstand winds as high as 60 mph, the reflector directs signals from outer space to a small antenna at the focal point.
—Photo by Sol Goldberg

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This issue, November, 1948.

Modernization of Railroad Passenger Facilities

By OLIVE W. DENNIS, C.E. '20

NOW what the heck can a woman do in engineering?" That was the remark I overheard as I walked in the commencement procession at Cornell many years ago. I did not agree with what the speaker's tone of voice implied, because I was convinced that good engineers are not made of brawn alone, but of brains as well. I hoped to have enough brains to compensate for any lack of brawn. Fortunately for me, the president of the Baltimore and Ohio Railroad also did not agree with the speaker. He gave me the chance to show that a woman with a technical background has a definite contribution to make to the railroad industry.

This opportunity came after fourteen months spent as a draftsman in the bridge engineering department of the B&O. Here I calculated ratings on old bridges and stress sheets for new ones. I figured the loads from locomotives of different types and from heavy freight shipments with unusual concentrations of weight. These had to be checked with the ratings of the indvidual members of the bridges over which they were to travel. Sometimes a bridge with a low rating could handle a higher load safely because it was not weak in the detail affected by this particular load. In the drafting room my work was computing, making drawings and tracings—not much brawn required there!

My assignment as Engineer of Service was, as far as I know, the first of its kind given to a woman. It meant study of the service on the Baltimore and Ohio through first-hand observation as a passenger. I rode on all the scheduled passenger trains over more than 5,000 miles of line, covering 44,000 miles the first year and nearly that much during each year since. Men had done this for years, but this was the first time the service was to be studied from a woman's point of view, an important angle since almost half the road's passengers are women. The fact that I have been retained since 1921 in this line of work proves, I believe, that a woman has something to offer toward railroad improvement. Other railroads beside the Baltimore and Ohio are beginning to recognize this fact, although some railroads seem to be content to catch glimpses of the women's viewpoint through the eyes of the wives of their officials, their employees, or through complaints from women passengers.

It might appear on the surface that my engineering education at Cornell was wasted. It is true that I am not now working with a slide rule and tables of bending moments, shearing stresses and the like. I probably would have a hard time today trying to determine the safe load for a beam or column. But the general training my engineering course gave me is invaluable. It helps in my approach to a problem, my analysis of what is wrong with

The interior of an old coach, originally built in 1929, and the interior of the same coach after remodeling. The reconversion starts with the stripping of the worn facilities and fixtures. There will be fewer seats; consequently more leg room will result. Remodeling includes the addition of the latest in ventilation and air conditioning. *—Courtesy B&O R.R.*

A diesel engine being lowered into the framework of a diesel-electric locomotive at the plant of the American Locomotive Company. Engineers predict that 35,000 steam locomotives will be replaced by diesel-electrics in the next decade. *Courtesy General Electric Co.*

The "Before" and "After" of a B&O coach rebuilt in the Mt. Clare Shops. The original coach, built in 1929 by the Pullman Car and Mfg. Company, has been almost completely dismantled, and the old, high roof has been replaced with the rounded contours of a modern car roof. Double-width windows have been added, and welded sheathing applied to the sides.

—Courtesy B&O R.R.

a car or a method of operation, and my reasoning to a concrete suggestion for improvement. Persons who are technically trained learn to observe details and to think. They are taught to reason back from observations to underlying causes, and to find how to remove, correct or modify them.

Along with the technical training for which I am grateful to Cornell, I make full use of a woman's natural tastes and talents. My instincts as a homemaker, anxious to have people comfortable and happy, bring to my attention the things that are annoying in railroad travel. I notice the small person who wriggles around in the lounge chair that is too deep or too high. I notice the long-legged man who is cramped when seats are too close together. I notice dirt in the upholstery and in the corners of the floor, bad odors and stuffy ventilation. I am interested in the way we handle passengers in stations as well as on trains, and the way we train those responsible for it. All this is only a larger form of a woman's work in running a home.

I am familiar with the things that women like in their surroundings. They like the cheerfulness of bright colors; they want lounges and station waiting rooms furnished like rooms in a home and not with a stiff arrangement of straight armchairs in regimented rows of identical units. In dressing-rooms women not only like but need an abundance of well-placed mirrors with adequate lighting. They cannot be happy surrounded by walls decorated in colors which reflect unflatteringly on their complexions. They do not enjoy sitting under fluorescent lamps and beside special window-glass which make everyone look on the point of death, if not already in a state of putrefaction. On the other hand, women do not want to look at themselves in mirrors of flesh-colored glass or illuminated by rose-tinted lamps. Neither of these give the true picture of the make-up they have so carefully applied.

In dining cars women are particularly sensitive to attractive china and a pleasing and orderly set-up on the tables. Women cannot tolerate sloppiness in dishwashing or stained tablecloths. They want lighter dishes on the menus, such as an abundance of salads and dainty sandwich plates. Women may, as the statisticians say, have the control of the spending of 80% of the national income, but they do not like to squander it. They are not usually as lavish spenders and tippers as men. They like the inexpensive snack bars and overnight coach trains. They are good bargain hunters and like to get their money's worth.

Meets With Cooperation

I meet with wholehearted cooperation from the various departments of the B&O. Many of them do not hesitate to ask for my help in solving a problem. They do so particularly in cases where women are concerned or when shopping is necessary to locate a scarce article

THE AUTHOR

Now Research Engineer for the Baltimore and Ohio Railroad, Miss Olive W. Dennis received the degree of C.E. in 1920, the second granted by Cornell to a woman. Previously she had received an A.B. from Goucher College and an M.A. from Columbia University. Since leaving Cornell, Miss Dennis has been with the B&O, serving as Draftsman, Engineer of Service and Research Engineer.

During World War II she served as Engineering Consultant for the Office of Defense Transportation, collaborating on a survey of jobs suitable for women on railroads. Miss Dennis is a Phi Beta Kappa and a charter member of the National Association of Railroad Women, and she was the first woman member of the American Railway Engineering Association.

Olive W. Dennis

that cannot be purchased through the usual channels. I work very closely with the mechanical department in the design of new equipment and the modernization of the old.

From many years of experience working with cleaning forces and shop men one learns to appreciate the exacting requirements of a public railway service. These requirements are due not only to the ruggedness of railroad operation but largely to abuse from inconsiderate passengers. Every new design and new material must be studied from the angle of durability as well as appearance. With the help of the mechanical department I study new materials for unaccustomed applications. Sometimes plastics and metal alloys can be made to reduce the staggering cost of cleaning and repairs in passenger cars.

Twenty years ago we began using ceramic tile in the passageways of dining cars. Rubber and linoleum floorings gave us trouble by buckling and coming loose at the edges so that water could seep underneath. The water soon rusted parts of the car structure, and the loose covering provided breeding places for vermin. This vitrified tile can also be used on the floor around some coffee shop counters and on the floors of toilet rooms and small lavatories. The hard tile is not only more sanitary, but it simplifies cleaning, and it never wears out. If through some abuse a tile or two will crack, others can be set in without re-laying the whole floor, which would take the car out of service.

Positive Colors Preferred

At my suggestion, enamelled wallboard was used on the sidewalls of passenger cars. The Marlite we use saves cleaning costs. Wiping with a damp cloth will remove fingermarks which would require hard scrubbing on walls where the enamel is just sprayed or painted on. Marlite does not scar as easily as a painted wall, and is much more permanent. In addition, the bright finish gives shiny interiors with cheerful colors, not the usual "decorator's colors" of mauve and taupe and pale pastels. The modern public taste runs to positive shades of Persian red, bright blues, greens and yellows.

On the B&O we also make much use of stainless steel in our interiors. It serves as a molding over joints in the wallboard, for baggage racks, for shelves and containers in washrooms, and as a protective facing for wainscote walls which receive hard wear. We have not gone to the extent of using bare stainless steel walls to the full height in vestibule entrances. We think the plain metal looks cold when not combined with color on some part of the wall.

New Plastic Headrest

An important item in the recurring costs of passenger coach maintenance results from the handling, laundering and replacement of the fabric headrest covers used on seats in long distance coaches. The answer to this problem is a type of plastic headrest now being manufactured. The plastic can be washed while on the seat. One set per car replaces the three sets formerly needed to allow free laundering time. The saving with this type of headrest will be substantial. They are sanitary, always look neat and improve the appearance of the car.

I enjoy the noisy confusion of the Mt. Clare Shops of the B & O for, really, it is not confusion at all but a bubbling activity. Here we repair and rebuild locomotives and freight cars and, in another section of the shops, maintain and rebuild passenger cars. Some of the passenger cars are just renewed and freshened up "in kind." But some are remodeled and modernized into cars of new types, and this involves a complete rebuilding. All of us who work on these jobs get a gratifying sense of accomplishment when we see a bright new interior blossom from the uninteresting drabness of an old-fashioned car. I get my biggest thrill when I take part in this process of building new cars out of old. We recently modernized some day coaches which we do not hesitate to display beside the new coaches turned out by car manufacturers. Indeed we have sent one to the Track Exhibit at the Chicago Railroad Fair.

A complete modernization job is almost as much work as building a car in the first place. Sometimes an old coach is converted into a Snack Car with lunchroom and lounge, and this requires much modification of the interior. But even when just rebuilt into a coach of more modern style, the old car must first be almost completely dismantled. The old, high roof with its square clerestory outline is replaced with the lower, rounded contour of the "turtle-back" roof now identified with

(*Continued on page* 34)

An intermediate stage in the reconversion of an old coach. A rounded ceiling is evident, and long picture windows have replaced the narrow type. Outlets for the air conditioning are being installed. *—Courtesy "Steelways"*

THE CORNELL RADIO ASTRONOMY PROJECT

By WILLIAM E. GORDON

Research Associate

A RADIO telescope has been designed and is being assembled near the East Hill Airport by Cornell engineers. When completed it will be used to explore the heavens. Analagous to an optical telescope, it has a 17 foot parabolic reflector mounted on a polar axis which will be driven to follow the motions of the sun and stars. Instead of visual or photographic observation, the information is obtained from a sensitive receiver fed by a small antenna at the focal point of the reflector. Radio telescope observations do not require clear skies as in optical work, but can be made equally satisfactory when clouds and poor visibility are present. The result of the cooperative efforts of mechanical, civil and electrical engineers, the telescope will be used in a radio astronomy investigation jointly sponsored by Cornell University and the Office of Naval Research.

Designed to withstand winds up to 60 miles per hour and to track with an angular error of less than one half of a degree, the telescope sees areas of the sky whose diameter varies from about 2 to 30°, depending on the frequency employed. In addition to the usual astronomical polar and declination axes, there are two other rotations available; one about a vertical axis to facilitate calibration of the antenna, the second the rotation of the reflector about its own axis for polarization studies.

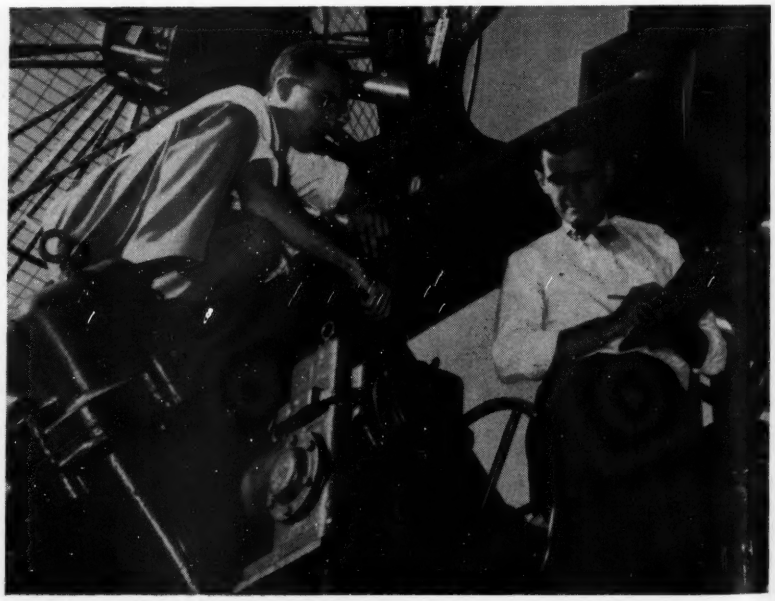
The sun radiates at all frequencies of the electro-magnetic spectrum, thus including not only the obvious light and neighboring frequencies, but also the radio portion of the spectrum. The radiation at the radio frequencies is too weak to be detected by commercial broadcast receivers, but occasionally presents interference in the form of static to the shorter wave bands. This static from the sun and other sources in space, which arrives at the surface of the earth, is the subject of the radio astronomy studies.

The earth's atmosphere is transparent to electromagnetic radiation near the visible portion of the spectrum. Through this window approximately one decade broad, man has obtained virtually all of his knowledge of the universe. A second window exists in the atmosphere. This one is about three decades wide and is located in the shorter wave radio region of the spectrum (20 mc. to 30,000 mc.). It is through this window that the information from outside the earth called static or noise is observed by means of the radio telescope.

The Radio Astronomy Project at Cornell is in the School of Electrical Engineering where the directional antenna and extremely sensitive receivers are being designed and assembled. At present, observations of our sun and galaxy are being made with a modified Army radar antenna mount and a 200 megacycle receiver. This equipment requires that an operator adjust the pointing of the antenna array to follow a prescribed course by means of a manual elevation control and motor driven azimuth control. The acceptance pattern of the antenna is approximately a 15 by 20 degree beam (between half power points) obtained from a 4 by 6 array of half wave dipoles. The initial observations are exploratory in nature, the solar program being aimed at evaluating a daily solar index, indicating the influence of the atmosphere, and surveying the equipment and observational problems. The purpose of the preliminary galactic work is to establish the radio pole of the Milky Way.

To investigate the nature and locations of the extra terrestrial radiation sources, the radio astronomy project is assembling receivers at 50, 200, 1400, and 3000 megacycles. To indicate the difficulties of design and measurement it might be noted that the noise signal from the undisturbed sun and the maximum signal from the Milky Way are only one twentieth of the noise generated by the receivers. The measurement of this small signal challenges

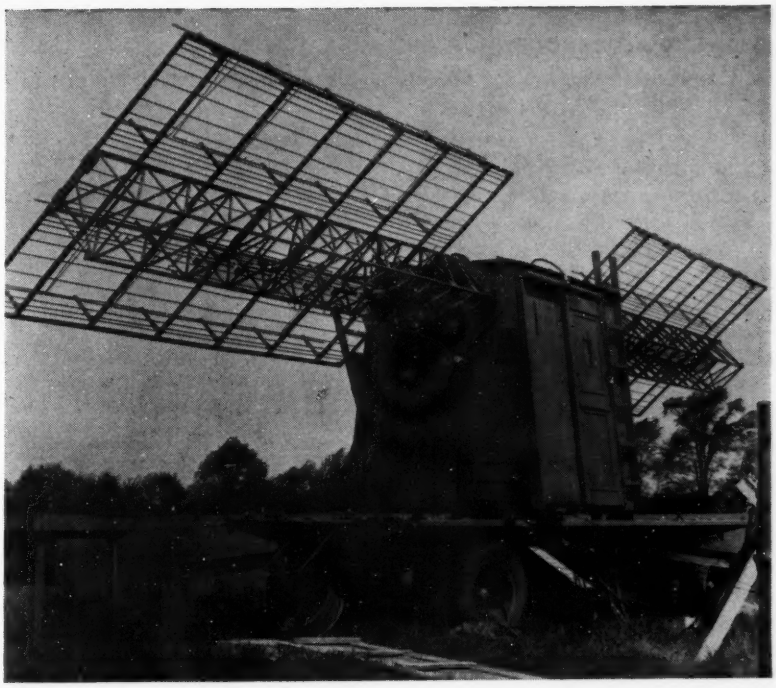
Prof. C. L. Seeger (left), who has carried on much of the investigation sponsored by Cornell and the Navy, and the author check the motor drive on the new radio telescope.



the engineering skill of the staff. An answer to this challenge has been obtained in two forms, each presently being tested. The scope of this article does not permit further discussion of this interesting phase of the work. However, qualitative measurements of the solar and galactic noise are now being made at the Airport Laboratory. Absolute measurements will be obtained in time.

The discovery of the existence of extra-terrestrial noise was a by-product of a study by Karl G. Jansky of the Bell Telephone Laboratories of the direction of arrival of high frequency atmospheric static. Jansky noticed a weak fixed source which appeared about four minutes earlier each day corresponding to a fixed location on the celestial sphere. An ingenious analysis determined that the source coincided approximately with the astronomical center of our galaxy, the Milky Way.

From this beginning less than twenty years ago has sprung the present interest and work in radio astronomy. The British, Australians, Canadians and French are active in this field. In this country the Naval Research Laboratory, National Bureau of Standards and Cornell University are engaged in the problem. The interest of the astronomers and astrophysicists is apace with the development of the radio technique of observation.



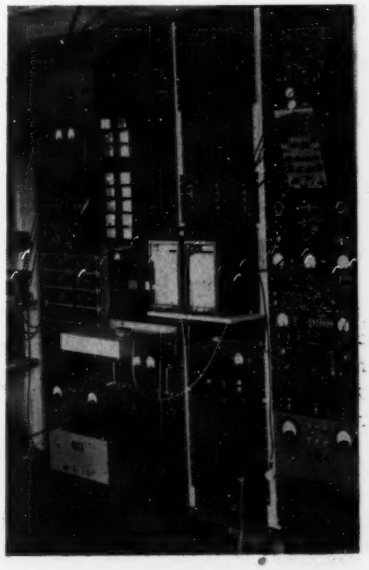
Modified radar antenna mount temporarily being used as a radio telescope. Radiation from the sun and stars in the radio portion of the spectrum has been detected and qualitatively measured by this 4 by 6 array of half dipoles.

As pointed out earlier, the radio telescope is analagous to an optical telescope. There are, of course, important differences. Thus a more detailed comparison should be considered. While we refer to the instrument as a radio telescope, it is both a telescope and spectograph since it accepts only a bandwidth of frequencies of the order of a megacycle. The radio telescope antenna must for both structural and economic reasons be limited in size to the same order as the wavelength of the incoming radiation. (At 10 centimeter wavelength the seventeen foot parabola corresponds to about 50 wavelengths.) This accounts for the fact that the radio telescope has an angular resolving power of the order of degrees compared with tenths of second of arc for optical telescopes.

Astronomical telescopes ordinarily record radiation of all polarizations indiscriminately, are sensitive to a large fraction of the optical range of frequency, and use receivers such as the photographic plate which integrate the effects over times the order of hours. In contrast to this the radio telescope has a preference for one plane of polarization, accepts only a small range of frequencies and integrates the effects over periods of the order of seconds or less.

Considering the many significant facts about our universe learned through the optical window of the atmosphere, the new radio telescope offers a rich mine of potential information.

The amplifying and recording equipment by which the small signals from extra-terrestrial radiation sources are measured.



THE AUTHOR

William E. Gordon, director of the Radio Astronomy Project at Cornell, received his B.A. from Montclair (New Jersey) in 1939, and M.S. from New York University in 1946. During World War II he was associated with the work on anomalous radar ranges as an Air Force officer at the M.I.T. Radiation Laboratory, Army Air Forces Board, and for the Committee on Propagation of the NDRC at Bell Telephone Laboratories. Before coming to Cornell in June of this year, he was associate director of the Electrical Engineering Research Laboratory at the University of Texas, engaged in basic studies of microwave radio propagation and related meteorological factors.

NEWEST PRODUCTION TECHNIQUES EVIDENCED AS WE TOUR THE PLANT

A Carrier Fighter In the Making

By THOMAS J. KELLY, ME '51

Photographs courtesy Grumman Aircraft Corp.

ALTHOUGH post-war cutbacks of military orders have stagnated most of the American aircraft industry, production of the *Bearcat*, currently the Navy's standard carrier fighter, still continues at the plants of the Grumman Aircraft Engineering Corporation on Long Island. The methods used in producing the Bearcat, direct descendant of the famed Wildcat and Hellcat, reflect advances in aircraft production technique made during the war, when aircraft manufacturers adopted many of the methods introduced by the automobile industry. However, many of the wartime techniques, developed when production only was important, have had to be altered now that cost is also a factor to be considered. Let's take a look into the Grumman plants and see how post-war airplanes are being produced.

A semi-serialized type of manufacturing is employed in producing the Bearcat. The principal subassemblies: fuselage, wing, stabilizer, rudder, and motor mount—are all made in separate departments and then joined together on the main assembly floor. Each of the major subassemblies, however, uses the finished products of many other departments. The wing, for example, contains parts from the controls, hydraulics, landing gear, ordnance, wing spar and small parts departments. There are also several departments where similar machines are grouped together because of their great bulk or objectionable operating characteristics. Typical departments in this class are: heat treat, drop forge, router, shear, press, paint and anodize.

Here's the finished product! An F8F-2 Bearcat, a $63,000 carrier fighter, undergoing its final acceptance tests.

Airframes require an incredible number of small parts and assemblies, most of which are merely stamped or punched out of a duralumin sheet. Even during the war the airplane manufacturers realized that it would be costly and impractical to keep one punch set up for each type of small part, and hence they adopted the practice of producing these parts in large quantity batches, and keeping a supply of them always on hand in production stockrooms. In producing the Bearcat, many large and rather intricate assemblies are stockpiled in this manner; examples are the plexiglass canopy for the cockpit and the armor-plate assemblies which protect the pilot. Hence there are several departments devoted to maintaining the production stockrooms, and the stockroom cages themselves occupy a large portion of the floor space in the plant.

This, then, is the general plan for the production of the Bearcat: all the major subassemblies are produced in separate departments, being made up of component parts fed to them by other departments which are grouped according to the types of machines they contain. The finished major subassemblies are then joined together as they pass down the final assembly line. With this general production procedure in mind we shall now go on a tour of the plants, to trace the development of the Bearcat from stock parts to a finished commander of the skies.

As we start our tour in the small parts production department, we see row after row of long workbenches where men are busy hammering and shaping small odd-shaped pieces of dural sheet which have been crudely shaped in the press, punch, and break departments. The men all use simple jigs, especially designed to position and

hold the part while they hammer the edge to the correct angle, drill or enlarge holes, or perform other simple operations. The finished parts of each type are bound together for delivery to the production stockroom, usually in lots of one hundred. The men obtain the parts from—an icebox! Yes, a large butchers'-type icebox is used to store the parts which are waiting to be shaped at the workbenches; it is maintained at a temperature of twenty degrees below zero, and prevents the age-hardening of the duralumin, keeping it soft so that it can be easily worked at the benches. After the parts are shaped into final form and allowed to stand at room temperature for several days, their hardness and strength more than doubles.

Hydraulic Presses

Next we visit the departments which feed those small parts to the benchworkers for final shaping. In the press department we find several very large hydraulic presses, of the same type used to press out automobile bodies, along with many smaller ones. The workmen place the dural sheet on the dies, which are securely bolted to the sliding worktable. They then cover the sheet with thick pieces of sponge rubber, which reduces the chance that the metal will crack. Usually the presses produce about five hundred of each type of part before changing over to another part.

In the router room, huge shears and flying knives cut up dural sheet into strips, squares, or whatever form is desired. This is one of the most hazardous and unpleasant jobs in the plant; the air rings with the whining and screaming of the huge circular saws, and the dull metallic thumping of the shears. Flying chips and ribbons of metal make it necessary to wear gloves and goggles at all times while in the router room. It is here, however, that the most basic operation is performed on the large, clumsy sheets of dural straight from the rolling mills: the sheets are chopped up into useable sizes.

Next we move on to one of the main subassemblies—the fuselage department. Fuselages for the Bearcat are produced in an amazingly small space, when compared to the large floor area occupied by the benchworkers making seemingly insignificant small parts. The fuselage is composed of two main sections, the cockpit and the tail. Both are set up in a series of special jigs; the first jigs position only two or three main beams and structural members, the next jigs permit special fittings such as control lines, instruments, etc. to be installed, and the final jigs position the skin for riveting.

The procedure used in working with these jigs, joining jigs as they are called, follows a standard pattern. As soon as the component parts are positioned in the jig, the workers drill out all the holes necessary to rivet the assembly together. The location of these holes is fixed by the jig. Then, if possible, the rivets are placed in these holes and either squeezed with a portable rivet squeezer or shot with a rivet gun. In most cases, however, it is impossible to reach most, if not all, of the holes while the assembly is still in the jig. For this reason a special type of clamp, called a *kliko button,* must be employed. These buttons are made in various sizes to fit drilled holes, and are easily inserted using a special type pliers. Once the button is placed in the hole, it will hold together the pieces of material it passes through until it is removed again with button pliers. Kliko buttons are one of the greatest time-savers developed for the aircraft industry, and are used today by the hundreds of thousands in every aircraft factory.

Explosive Rivets Used

Because of the intricacy of the fuselage, there are many places in which it is impossible to hold a bucking bar behind a rivet to make it flatten out. Early in the war aircraft plants made a special effort to hire midgets to crawl into such cramped places and get those tough rivets. Soon, however, explosive rivets were developed which did not have to be bucked; a touch with a hot soldering iron set off a small explosive charge in the end of the rivet, spreading it out. These explosive rivets are in general use today.

After the cockpit and tail assemblies have been completed (and they are surprisingly complete, even at this stage of assembly; the instrument panel in the cockpit looks exactly like it does in the finished plane), they are mounted in a large joining jig which positions them exactly while the ribs and stringers of the center section of the fuselage are placed in position between them. Unlike the cockpit and tail sections, which are compact, neatly packaged units, the center section is merely a connecting link, and is assembled piece by piece after the other two fuselage sections are in position. After the center section

An interior view of Grumman's Plant 2. The Bearcat final assembly is at the far left, while in the center are wing production jigs. In the final assembly line, the rolling jigs are mounted on rails so that the ships can be rolled down the line by hand.

The Bearcats' den—an aerial view showing the four Grumman plants and runways. Manufacture of the Bearcat continues at these plants located on Long Island.

ribs and stringers have been riveted in place, the center section skin is fitted. (No way has been found to make the skins fit exactly on every ship. They are all cut from standard templates with portable electric shears, but some filing and trimming is always necessary when they are placed on the ship.) The skin is then riveted on, and the ship is removed from the jig. The fuselage is now finished, and is moved out onto the main assembly floor on special rolling dollies.

Wing Subassembly

Production of the wing, another main subassembly of the Bearcat, procedes in a fashion similar to that of the fuselage. In this case the two main sections are the center spar and the wing panels. Each of these units is set up in positioning jigs, where the basic elements are riveted together. They then move to other jigs where controls and hydraulic lines are added. In a large joining jig, the wing panels are connected to the center spar, and the wing begins to take on its finished appearance. The landing gear is connected to the wing while it is still in the joining jig, and by means of portable hydraulic pump equipment the wheels can be raised, lowered, and completely checked before the wing is even removed from the jig. The Bearcat has a folding wing to conserve precious space on carrier decks; the folding tips are attached to the wing after it is removed from the joining jig.

The rudder and stabilizer assemblies are relatively simple to produce; each is made on just one jig. Because of the narrow sections encountered, explosive rivets must be used quite frequently. Rudder and stabilizer surfaces are especially subject to vibration and wear from slipstream, and hence precautions must be taken to eliminate these features. A relatively thick dural skin (.050″) is employed on the leading edges, while the upper and lower surfaces are .042″ thick. Tight fitting rivets are insured by using chilled rivets, which expand to tightly fill the holes as they come to room temperature; the heads of the flush rivets are carefully trimmed with a compressed-air powered rivet shaver to insure a smooth skin surface. The skins used on the rudder and stabilizer, as well as those used on the fuselage and wing, must be free from all scratches, because even slight scratches on the skins tend to concentrate stresses due to vibration, which may result in cracking. To eliminate scratches, all skins must be painstakingly polished by hand with soft emery cloth before they are anodized and then covered with their distinctive pale-green protective coat of zinc chromate primer.

Motor Department

We shall now visit the motor department, where the last major subassembly of the Bearcat is prepared. The Bearcat uses an 18 cylinder, radial, air-cooled Pratt & Whitney engine, rated at 2400 h.p., 2650 with water injection. The engines arrive at the Grumman plant completely wrapped in transparent Koroseal and covered with protective grease. In the motor department the engines are uncrated, cleaned, fitted to Bearcat motor mounts; starter, supercharger, oil coolers, etc. are added, and the whole assembly is completely fitted with the necessary electric wires, hydraulic lines, and control cables. These operations are performed rapidly by gangs of workers specializing in one particular series of operations; the engines are supported on rolling dollies, and are moved by hand from one work station to the next.

Now that we have seen how all the major subassemblies which make up the Bearcat are produced, we stroll out onto the main assembly floor to watch how the five principal units are jointed into one $63,000 carrier fighter. At present only one assembly line is being used; it is a 600 foot long line of rolling jigs which support the fuselages and yet leave room for all the other units to be attached. The tail fin and rudder are put on first, then the wing, and then the stabilizer. The tail fin and stabilizer each are attached with only four bolts, and connecting control lines and electrical wires takes but a short time. Considerable time is required to completely connect the wing, because of the maze of hydraulic lines which must be installed.

The rolling jigs are mounted on rails, and the ships are rolled by hand down the line. At each station on the line a crew of workers swarms over the ship, each with one small job to do, like installing one oil line or checking one set of electrical connections.

After the wings and tail assembly have been connected, the engine assembly is hung on the front of the

(*Concluded on page* 34)

New Fields in Luminescence

By DONALD MACGREGOR, ChemE '52

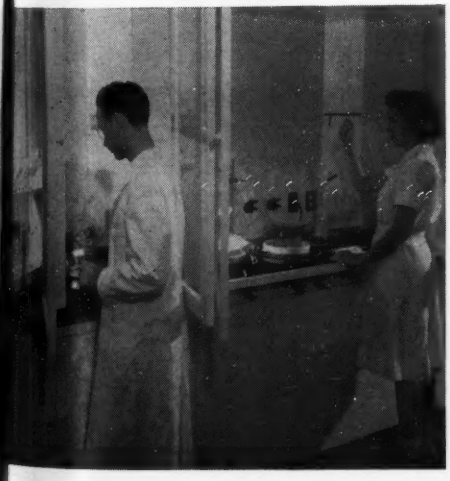
Photographs courtesy Radio Corporation of America

That phenomenon called luminescence has been known to man since antiquity, but scientific study of the subject began less than a century ago. Interest in luminescence increased with the introduction of fluorescent lamps, and the possibility of military applications gave luminescence research added impetus during World War II.

IN this age of scientific and inventive genius, we turn on a fluorescent lamp or perhaps adjust the dials of a television set without thinking a great deal about the problems which had to be placed in the hands of the consumer.

Development of luminescent devices has also presented many problems of an engineering nature. Applying a coat of luminous material to the inside surface of a glass tube or a cathode ray tube is a difficult operation; the coating must be uniform and free of impurities and each coating must exactly duplicate its predecessor. The synthesis of luminous material on a comercial scale is another thorny problem. Thus to convert luminescence from a curiosity to a modern miracle-worker required research by chemists and physicists and development by engineers.

Mixing purified phosphor constituents in compartments to prevent cross-contamination. Exclusion of foreign metallic impurities and rigid control in mixing are necessary to give phosphors of desired luminescence.



The phenomenon of luminescence may possibly have been known to the ancient Egyptians, as several references are made in ancient Egyptian literature to substances having properties similar to those of luminescent compounds familiar to us today. Medieval literature abounds with descriptions of luminous stones, but the earliest documented investigation of luminescence occurred in the early seventeenth century.

Luminescent History

The authenticated history of luminescence begins with Vincenzio Casciarola, a cobbler in seventeenth century Bologna, Italy. Casciarola dabbled in alchemy when not occupied with his boot-making. In his search for the "philosopher's stone," goal of every alchemist, he heated a mixture of barium phosphate and barium sulfate in his fireplace. The result was a material which emitted a reddish glow. Casciarola named this product "lapis lunaris" or "moon stone" because like the moon it emitted the light it had received from the sun. Over two and a half centuries passed before Casciarola's "moon stone" was identified as impure barium sulfide activated with bismuth or manganese.

The next important advance in the field of luminescence came in 1852, when Sir George Stokes, making an intensive investigation of luminescence associated with several types of fluorite, called the phenomenon he observed "fluorescence" because it was exhibited by fluorite. Sir David Brewster in 1833 had explained the luminescence of an alcoholic solution of chlorophyll exposed to sunlight as due to internal dispersion. Sir John Herschel, studying the luminescence of a quinine bisulfate solution in sunlight, decided that "epipolic dispersion" (surface dispersion) was the cause. It remained for Stokes in 1852 to correct this concept held by all the early scientists: Boyle, Hooke, Newton, Herschel, and Brewster. Stokes discovered that luminescence is a re-emission of light and not a dispersion or diffusion of the incident radiation. Another result of Stokes' work was the fundamental law of luminescence which bears his name.

The scientific study of luminescence begun by Stokes was carried on by Edward Becquerel, who in 1859 began measurements of wavelength of the exciting and of the emitted light, duration of the afterglow, and who noted the influence of temperature and other factors, examining many types of luminescent materials in his study.

Luminescence became increasingly important in scientific research

in the last decades of the nineteenth century as Verneuil, Lenard, and Klatt found that mineral phosphors owed their luminescent properties to the presence of metallic impurities, and that in the manufacture of synthetic phosphors, perfectly pure chemicals are required. At the same time Crookes and Goldstein were investigating luminescence caused by cathode rays. Fluorescent screens were used in the discovery of X-rays and indirectly in the discovery of radioactivity, and cathode ray luminescence played an important part in the discovery and separation of the rare earth metals by Crookes and Boisbaudran.

The first fluorescent lighting tube, developed by W. S. Andrews in 1912, was abandoned as commercially impractical and less than twenty years ago it was felt that the fluorescent lamp had no future.

Theory of Luminescence

"Luminescence is the emission of light by molecules brought into excited states without increasing their average kinetic energy or without heating the system." It is not to be confused with incandescence, which is light emission produced by heating a body to high temperature. Luminescence can be either of two classes: *fluorescence,* which is the emission of light with the exciting agent present, and *phosphorescence,* which is the emission of light after the removal of the exciting agent. It is believed that the radiation from the exciting agent causes a shift of electrons in the luminous material to a higher energy level within the atoms. The return of these electrons to their stable condition is accomanied by a release of energy in the form of emitted light. This transition takes place normally in 10^{-8} seconds; thus in fluorescence there is an afterglow of this duration to enable the electrons to return to a stable state. In phosphorescence, however, the electrons are delayed in their return to their original position; this accounts for the sustained afterglow which may persist for seconds, minutes, days, or even months. Phosphorescent afterglow is always more than 10^{-8} seconds.

Luminescent materials can be divided into three main classes: 1) organic compounds, 2) pure inorganic compounds, and 3) inorganic crystals and glasses activated with inorganic impurities. This third class includes most of the natural fluorescent minerals.

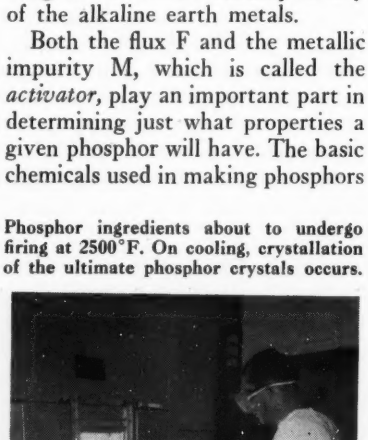
Many of the fluorescent organic compounds are dyestuffs; but only 85 of the 1450 dyestuffs listed in the Colour Index are characterized as fluorescent. Generally those organic compounds with complex structures are more likely to fluoresce.

Pure inorganic compounds which are luminescent are few, consisting solely of the trivalent positive ions of the rare earths dysprosium,europium, gadolinium, samarium, and terbium; the uranyl ion; the platinocyanide radical; and the siloxene group ($Si_6H_6O_3$).

Inorganic crystals and glasses activated by inorganic impurities were first referred to as "phosphors" in the middle seventeenth century. The term phosphor means "light bearer" and antedates the discovery of the element phosphorus by two decades. Most synthetic phosphors have the formulation: AB+M+F =PHOSPHOR. M may be a trace of any heavy metallic impurity. The anion B may be a selenide, sulfide, or an oxygenated compound of boron, carbon, germanium, molybdenum, phosphorus, silicon, tin, or tungsten. The cation A may be any of the alkaline earth metals.

Both the flux F and the metallic impurity M, which is called the *activator,* play an important part in determining just what properties a given phosphor will have. The basic chemicals used in making phosphors must be of the highest grade, often exceeding the purity of the best analytical reagents. The purity of the base materials of phosphor manufacture may parallel the purity of compounds used in atomic weight determinations. Every effort is made to exclude foreign metallic impurities and to control rigidly the amount added during manufacture.

Phosphor ingredients about to undergo firing at 2500°F. On cooling, crystallation of the ultimate phosphor crystals occurs.



The purpose of the flux is to aid the diffusion of the activator through the crystal lattice of the base material. The raw materials are fired at a temperature between 800 and 1500°C. for a half hour to a period of hours. This firing accelerates activator diffusion and determines the particle size and crystal structure of the phosphor.

By changing the metallic impurity employed or by varying its concentration, it is possible to bring about changes in the luminescence of the phosphors being prepared. Often if the optimum concentration of the activating impurity is exceeded, a loss in luminous efficiency results. Concentration ranges from a few parts per million, ratio of activator to base material in most sulfide phosphorus, to from one to five per cent by weight, the optimum activator concentration for silicate phosphors. Some base materials, notably molybdates, tungstates, and zinc and cadmium sulfides, are fluorescent without an activator, but require activation to be phosphorescent. Cobalt, chromium, iron, lead, and nickel are capable of altering phosphorescence in sulfide phosphors; the presence of as little as one part of one of these elements in ten million parts of base material means a 75% loss in phosphor efficiency.

Other factors which have a decided effect on the phosphor are the method of preparation, the heat at which the phosphor material was fired, the duration of the firing, and the nature of the flux.

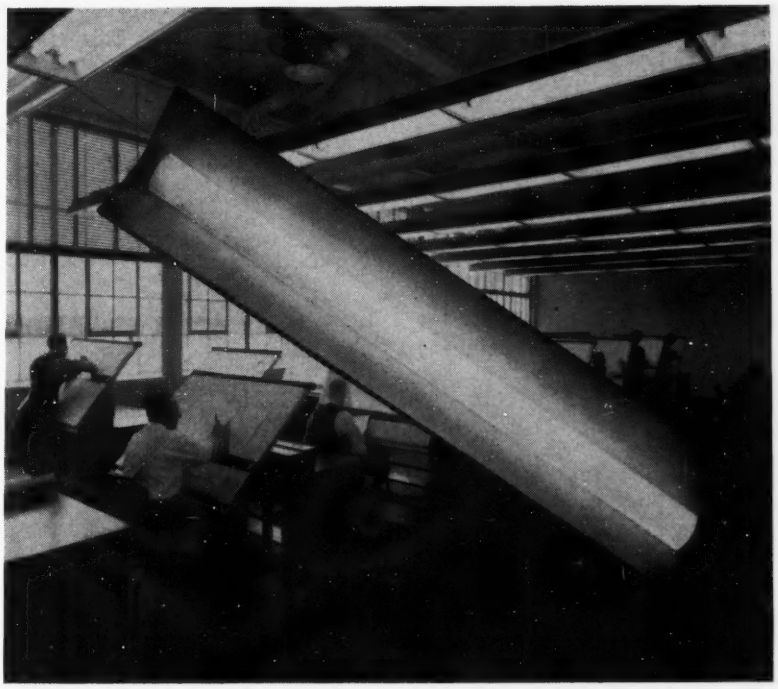
By correct manipulation of these different factors, it is possible to produce a phosphor tailor-made for a definite application. A phosphor can be made in any color of emission, or any duration of phosphorescence; one type will glow for several minutes after excitation for a millionth of a second; another is sensitive to any cathode ray voltage

from six to six million volts; some are sensitive to an electron beam current of as little as one hundred-millionth of an ampere. It is possible for a phosphor coating .0004 inch thick to have, under an electron bombardment of seventy thousand volts, a brightness 150,000 times that of a well-lighted printed page.

Applications

The most common use of luminescence today is in the fluorescent lamp. This lamp is gaining in popularity over the incandescent lamp because a greater percentage of the electrical energy supplied the fluorescent lamp is converted into radiation of wavelengths suitable for illumination. Much of the energy supplied to an incandescent lamp is emitted as infra-red radiation. The fluorescent lamp consists of a glass tube coated on the inside surface with a phosphor or a mixture of phosphors. At either end of the tube is an electrode of coiled tungsten wire with a small amount of mercury. Application of an electrical potential to these electrodes produces mercury vapor which fluoresces, emitting ultraviolet radiation to excite fluorescence in the phosphor. The phosphor particles in this coating vary in size from .00008 to .0002 inch in diameter. A typical forty-watt daylight tube contains ten billion particles in its coating, yet the total weight of the particles is between two and three grams. This forty-watt tube produces as much light as a hundred-watt incandescent lamp. Since the peak of the mercury vapor fluorescence is at 2537 angstrom units in these fluorescent lamps, the phosphors selected for use must have their maximum sensitivity to ultraviolet radiation in the 2500-2600 angstrom unit range.

Fluorescent lamps were first produced in the early 1930's in France and Germany. The design of a practical low voltage fluorescent lamp was first undertaken in the United States in 1934, and in September, 1935, the first public exhibit of such a lamp was held. In April, 1938, these lamps were made available to the general public in four sizes and six colors: daylight, white, pink white, blue-green, gold, and red.



A typical installation of fluorescent lighting. Economically efficient, the fluorescent lamp converts a greater percentage of electrical energy supplied into visible radiation than does the incandescent lamp.

Research has improved these lamps to the point where a life of one thousand to fifteen hundred hours of use is expected.

Criminology and police science use fluorescence in examination and identification of fingerprints, scars, tissue stains, blood stains, documents and inks, spurious gems, and in tagging evidence, in toxicological tests, and as a death test (a fluorescent dye injected into the blood stream will be circulated if the person is alive).

Unique Lighting Effects

Advertisers use fluorescent posters and signs to convey an impression of life or to give their display a three-dimensional effect. The unique lighting effects made possible through the use of fluorescent materials sensitive to ultraviolet radiation have resulted in wide use of papers, cloth, and plastics containing fluorescent dyes, paints, and pigments in theatrical costumes, makeup, and stage sets.

In many fields of medicine fluorescence makes the task of diagnosis much simpler. It offers the advantage of speed, certainty, and harmlessness. The study of skin diseases, abnormal growths, and pathological tissue of almost any kind is easier when ultraviolet radiation is the source of illumination. Brightness of fluorescence increases with tistue density; thus bone or muscle tissue can be distinguished from glandular, epithelial, or adipose tissue under ultraviolet radiation. Calloused, bruised, diseased, and inflamed tissue may be discovered simply. In the field of bacteriology, several pathogenic organisms are more readily identified when stained with fluorescent dyes and examined under ultraviolet radiation.

The use of phosphorescent materials on watch or clock dials to make them visible in darkness is very well known. Usually this material is zinc sulfide activated with mesothorium or radium. The chief disadvantage in using this phosphor is its high cost, ranging from ninety cents to ten dollars per gram. A very important use of phosphorescent materials during the recent war was the illumination of dials on aircraft instrument panels. The faint glow of the phosphor made the dial visible and at the same time main-

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The Editor's COLUMN

Professional Registration

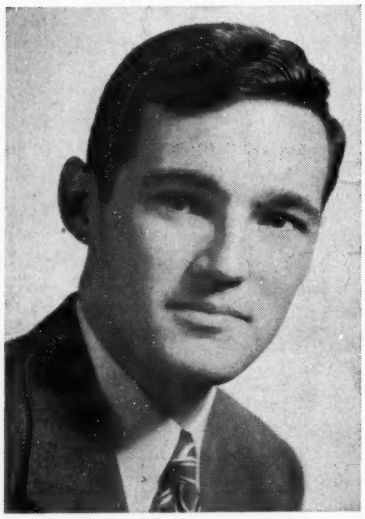
The subject of professional registration is not a new one. In theory it goes back to the advent of the guild system when the guilds set up their membership requirements and a system of policing themselves for unethical practices. In the eighteenth and nineteenth centuries, however, professional registration gradually passed into the control of the state, where it rests today.

Perhaps the best known form of registration is that of the legal profession. To practice in a given state a lawyer must not only pass that state's bar examination but must constantly live up to the high standards of professional conduct set up by that state. Less well known, but gaining in recognition are the various state laws requiring registration of engineers. These Engineering Examiners are neither uniform nor modern. However, progress is being made toward the ultimate goal of one uniform law for all the states. One organization which is doing much to further the cause of engineering registration is the National Society of Professional Engineers. It is composed of 17,000 registered engineers and serves as a voice for the profession on economic, social, ethical, and professional problems.

The legal basis of registration rests upon the police powers of the state to protect the public health and safety. Practically every design, operation, and process undertaken by an engineer has public implications. Thus it is seen that the public as well as the engineer has a stake in professional registration.

As engineering students it would be well for us to think of the benefits of professional registration in order that we may not only help raise the standards of our chosen profession but further our own careers by the early acquisition of an accepted badge of competency.

PROMINENT



Bill

William R. Elmendorf, EE

Cornell seemed to be a logical choice for Bill Elmendorf, for both his father and uncle attended Cornell, and Ithaca is his father's hometown. Because his family has done considerable moving, Bill found himself living in various places from Maine to California before bringing the family name back to Ithaca.

After graduating from Garden City High School in 1942, he entered the School of Civil Engineering. Bill tells of how, in his freshman year, he came to the offices of the ENGINEER to get a subscription, and before he knew what was happening, he was convinced (allegedly by tactics reminiscent of the Spanish Inquisition) to compete for a position on the magazine. Since this rather emphatic beginning, he has done a fine job both on the ENGINEER and in his other pursuits.

However, after five terms at Cornell, Bill had to exchange the part-time uniform of the Pershing Rifles for Navy blues. Upon being rated an Aviation Radio Technician, he had ample time to reconsider his choice of a career, and it was while in service that he decided to forego civil in favor of electrical engineering.

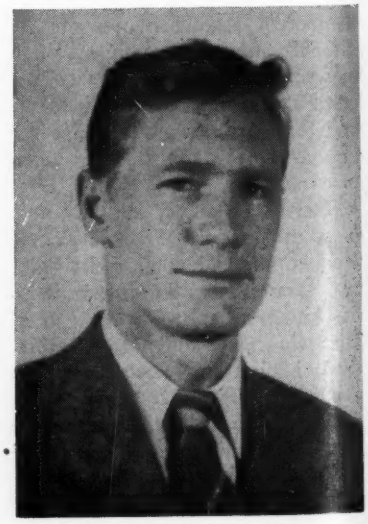
Transferring to the EE school upon his return in the Fall of 1946, Bill proceeded to build an outstanding record in his new field. He is a member of Eta Kappa Nu, honorary electrical engineering society, and of Pi Delta Epsilon, national honorary journalistic society, and the holder of a McMullen and a State Tuition Scholarship. A considerable part of his time is devoted to the ENGINEER, of which he was formerly Treasurer and is now Business Manager, and to WVBR, where he works in the Technical Department. Bill also participates in the activities of the Cornell Folk Dancers and the Cornell Outing Club.

Plans for the future are still somewhat indefinite, but Bill expresses a desire for work in electronics after his graduation in February.

William Wade, CE

With six years of Navy life to look back upon, Bill entered Cornell in November of 1945. A graduate of Technical High School of Springfield, Massachusetts, Bill decided to sign up with the U.S.N. for a short hitch in 1939. But the war

Bill



ENGINEERS

put a "hitch" in his plans and he wasn't discharged until October of 1945.

Setting his sights on a degree in Civil Engineering, it wasn't long before he had learned of the notorious Lincoln Hall clock. His first year passed swiftly by, and he wound up by making Dean's list both terms. With spring still linger-

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Peter Harriott, ChemE

If we were to measure the efficiency of men and machines by the noise that they make, Pete Harriott would be on the short end, but being an engineer rather than a law student, he is, despite his quiet demeanor, far from being an obscure member of that worthy group of survivors from Unit Op. ChemE 5353. His many activities and accomplishments not only command for him the respect of those who know him, but also make him a man much sought after when there is something to be done or a decision to be made.

His popularity and ability in chemical engineering are mirrored in his active participation in the various engineering societies; treasurer of Alpha Chi Sigma, (professional chemists and chemical engineers) for the past two years, he is now president of the fraternity; member of Tau Beta Pi and Pros-Ops, honorary engineering and chemical engineering societies, respectively; and program chairman for A.I.Chem.E. He also manages to shake the dust of Olin often enough to have participated in the Sage Chapel Choir for two years and actively engaged in the intramural sports program in basketball, softball, football, and badminton. While claiming sports as his chief hobby, he admits, parenthetically, to some extracurricular glass-blowing.

The son of Cornellians John F. and Stella F. Harriott, both of the class of '22, Pete entered Cornell in the summer session of 1944 from Classical High School, Springfield, Mass., under a McMullen Regional Scholarship, having decided, by his own admssion, that chemical engineering offered a pecuniarily bright future. Whether this prize still affords motivation or whether chemical engineering has gotten into his blood, he has tentative plans for doing graduate work in physical chemistry or chemical engineering. Having worked three summers in the plastics division of Monsanto, and the past summer at Standard Oil at Baton Rouge, he is already familiar with the industry for which he is training.

Pete

William S. Owen, Jr., ME

If you don't believe that track is the greatest sport at Cornell, just talk to Bill Owen. This is Bill's fourth year as a mainstay of the track team, and his years of competition have only served to increase his interest in the sport. Holder of three varsity track letters so far, Bill has demonstrated his versatility by starring in the broad jump, low hurdles, sprints, and javelin throw. This year his track teammates elected Bill co-captain, and he is also an active member of Spiked Shoe.

Bill

Bill came to Cornell in the summer of 1945, direct from McCallie Prep School in Chattanooga. Although his home is in Bluefield, West Virginia, Bill attended Bluefield High for only one year before going to prep school. Bill was young enough in '45 to just miss the draft, which makes him one of Cornell's first post-war non-veteran students. Coming to Cornell on a John McMullen Regional Scholarship, Bill has maintained an enviable scholastic record despite the great amount of time he devotes to track. Bill is at present recording secretary of Tau Beta Pi and a member of Quill and Dagger, while as a junior he was a member of Aleph Semach. Easy-going and greatly interested in people, Bill served this fall as a frosh camp counsellor. He is also one of the group planning the establishment of a Cornell chapter of Pi Tau Sigma, national M.E. honorary society. In his limited spare time, Bill amuses himself by fixing up old cars and swapping them for different, and sometimes even older, models.

Although he will receive a B.M.E. degree in June, Bill's primary interest is in administrative engineering. He has made no definite plans for work after graduation, but hopes to find a job which is "not straight paperwork." When he finally receives that coveted sheepskin, soft-spoken Bill Owen can look back to his college record with permissible pride.

Recent Developments In Engineering

Techni-Briefs

"Creep" Testing

Parts used in the construction of turbines must withstand large stresses and high temperatures simultaneously over prolonged periods. To insure that the parts will not change size or shape when subjected to these conditions the General Electric Laboratory at Schenectady conducts "creep" tests on various alloys. An engineer is shown investigating the creep test apparatus. Recently, a slender steel rod, known as "Item 1113," emerged in good shape after withstanding a temperature of 1000°F. and a tensile stress of 6000 pounds for a total of 50,000 hours (approximately six years). The usual creep tests last only about three months, but the record was set at 100,000 hours when four pieces of nickel chromium steel were tested from 1931 through 1942. Many G.E. engineers doubt if that record will ever be broken.

Television X-rays

Television, combined with X-rays, may aid in the detection of defects in thick sections of metal castings and other metal structures film. For more immediate study, without the need of processing the film, X-ray technicians sometimes use the fluorescope, a screen on which the X-ray image is formed and made directly visible by fluorescence.

For industrial use, there would be no objection to using the high X-ray intensities required to get a sufficiently high luminosity of the fluorescent screen, which could then, perhaps advantageously, be viewed by television. In industrial use, the advantage of the television method would consist of making it easier to provide adequate X-ray protection for the operator, who would thus be located at a remote point and behind a thick protective wall.

Plastic Sinks

A long sought for goal of plastics fabricators has been accomplished in the successful adaptation of plastics in wash basins and sinks. Formed by a skillful combination of fabricating techniques, the new sinks and basins are extremely light in weight and have shown remarkable resistance to the usual household hazards. The plastic used in the manufacture of these sinks, "Lucite" acrylic resin, is affected by a few of the chemical compounds found in the home but long range tests have shown that it will stand up indefinitely in the home application given ordinary care.

Tests have shown that proprietary medicines and cosmetic preparations did not cause damage if removed reasonably quickly. Abrasive household cleansers were found unnecessary as the plastic can be cleaned easily with plain soap and water. Water of bathing temperatures did not affect the plastic either, and fixtures can be easily and securely attached.

The sinks and basins are being produced in commercial quantities.

Humidity Test Apparatus

Through the development recently of humidity test apparatus, it is now possible to carry on research, calibration, and testing of hygrometers at temperatures below freezing. The apparatus was developed and built by the National Bureau of Standards, under the sponsorship of the Navy Department.

The use in recent years of radiosondes for the meteorological sounding of the atmosphere, an important aid in weather forecasting, has created a definite need for information on the performance of the humidity-sensing element in the radio sonde under conditions of flight. The function of the humidity test apparatus is to produce air of known relative humidity at temperatures from 0° to minus 40°C. In the new divided flow, a current of dry air is divided into two streams, one of which is maintained dry while the other is saturated with respect to ice; finally the two are recombined.

A proportioning valve is used to divide the flow of moisture-free air in a known ratio. One part is passed through a saturator over a series of trays containing ice, until it is completely saturated. It is then mixed in a mixing chamer, with the other part that has been mantained dry, and allowed to exhaust through a test chamber into the atmosphere. The saturator, mixing chamber, and test chamber are kept immersed in a constant temperature bath. The hygrometer or other device, which is being subjected to air of known and constant humidity, is inserted into the test chamber.

The essential functional units of the apparatus are the drying system, the proportioning system, the humidifying system, the mixing chamber, the test chamber, the cooling system, and the thermoregulating system for temperature control.

The over-all performance of the humidity test apparatus has been established by a series of gravimetric moisture determinations. For the temperature range of 0° to minus 40°C. and for air velocities up to 1500 ft./min., this instrument produces air whose relative humidity is known within three per cent.

(Concluded on page 40)

Competitive Environment of the Engineer

By ROBERT C. FENNER, M.E. '03

A Review of Several Questions of Fundamental Significance to the Engineering Student

At the close of my talk on "Some Specifications for Leadership" before the senior mechanical and electrical engineers last spring, a number of questions were submitted to me. These questions showed considerable interest in the subject and seemed so appropriate, that it was thought others might be interested in the replies. Accordingly, the questions are being repeated here with more complete answers than time permitted on that occasion.

What is your definition of success?

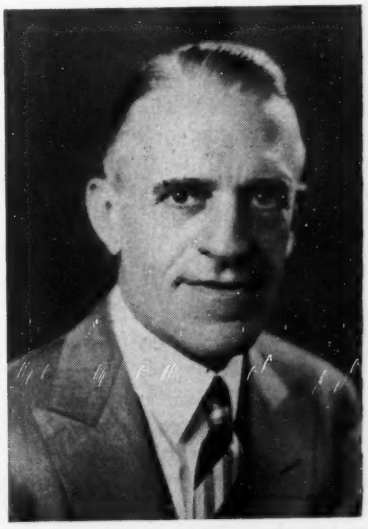
Reviewing the accomplishments of those who have made a success of their lives, I like to think of success in terms of contributions made toward the welfare of mankind. This can take various forms or show up in many ways and in all walks of life. To be successful, it does not follow that the accomplishments need be spectacular, or be heralded across the land. Many who have lead successful lives according to their limited talents and opportunities have been little heard of. Yet, measured percentage wise, their contributions have been most worthy. Many modest cases have been outstanding in their class, for success is an individual matter. In general it may be said that those who start with a constructive idea in any walk of life, and pursue it with diligence, resisting failures, rising above discouragements, enduring hardships in order to bring to fruition their cherished hopes and ambitions, are worthy examples of success. Their efforts and sacrifices result in benefits to mankind. More and better jobs are created, or new opportunities for others made possible. They add to the comfort and enjoyment of living. Their work is an inspiration to others. They contribute to our cultural and spiritual life. These are just a few ways which illustrate my idea of measuring success. In short, and applying it personally, ask yourself this question: "Is the world a better place in which to live because of my part in it?"

What type of competition is to be expected in the attainment of leadership?

Competition in jobs is somewhat like competition in business. You must have a good product at an acceptable price in a field where there is a demand. As a man climbs the ladder of success, the less his competition becomes. For example, it is more difficult to find a good works manager than a foreman. It is more difficult to get a good foreman than a mechanic. In ordinary times file clerks are plentiful, but it may take months to locate an able president. The higher you rise, the less the competition. The point is many peo-

THE AUTHOR

Robert C. Fenner is a recognized authority on administrative engineering and organization. After graduating from Sibley in 1903, he instructed for four years. Then he entered the shops and engineering department of Cutler-Hammer Company, later becoming manager of their Boston and Chicago offices. From 1916-1919, Mr. Fenner was an executive with the Zucker and Munning-Loeb Companies of New Jersey. Following ten years as a consultant, he became President of the Dixie Cup Company in 1929, and subsequently, until his retirement this year, was President and Chairman of the Board of Consumers Company of Chicago. Mr. Fenner is still Chairman of the Board of Central Scientific Company, and Director and Chairman of the Executive Committee of Butler Brothers, both of Chicago, and



Robert C. Fenner

Consulting Director of Keller Tool Company of Michigan.

ple quit too soon. Therefore, those who persevere and attain leadership, rise beyond the more competitive.

What is a sales engineer? How is he related to the rest of the company?

Usually a sales engineer is a technical graduate of a college like Cornell. Following graduation he enters a shop to learn the parts, assemblies, and how the products function. From the shop he may be transferred to the engineering department or test floor to further develop his knowledge of design and application. The engineering department frequently serves as the feeding ground for the sales department. If the candidate shows aptitude for sales he may be sent out in the field as a sales engineer. This is a typical case. Companies will vary the routine to fit the organization and the products.

In order to intelligently sell the company's products the salesman must know the product, its design, how it functions, and its application. He must know pretty much all the technicalities. As most installations require meeting specific conditions in the field, the salesman must know what the engineering department at the home office requires in the way of data and information which can only be secured on the spot. This information, when collected by the salesman, is submitted to the engineering department where preliminary design sufficent for estimating purposes is laid out, the cost figured, and price quoted. The salesman is therefore in constant relation with the engineering and production departments, but reports to, and is under the supervision of the sales manager.

Having enumerated and defined many qualifications for leadership, how do you use them in choosing an employee?

Assume there are several candidates within the organization. Each one is carefully reviewed. The first and foremost question is, "Is he capable?" "Does he have the requisite knowledge?" Then come an array of interrogations: "How about his personality?" "What is his attitude, disposition?" "Is he loyal?" "Does he possess good judgment?" "How does he get along with people?" "Is he respected by his coworkers?" "Can he lay out his work in an orderly fashion and delegate details?" "Is he efficient?" and many others. It is evident that the candidate rating the highest in these qualities is the logical one for promotion.

Some companies use a rating system, giving each qualification a certain weight. More often the employer relies upon his own acumen, after examining each candidate's past record and characteristics. He then selects the one best equipped all around.

Case: Small Union Shop. Should a new superintendent who observes time losses and wasteful methods, try to make rapid changes, or should he become more familiar with his staff and make slow changes?

Procedure depends largely on the specific case. Generally, however, the superintendent should first familiarize himself with union restrictions if any, and study the attitude of his union shop committee. In most small shops where workers have been fairly treated, they accept constructive changes without much opposition.

A new superintendent should first establish himself favorably with his foremen and staff members, so they come to know him and feel confidence in his sense of fairness and integrity, as well as his ability to intelligently deal with shop methods and practices. This may take a month or two. During this period the superintendent should become acquainted with all shop operations and the tenor of his men and their ratings. This will also give him opportunity to thoroughly study the contemplated changes and appraise the effects. In making the first change he can feel his way and observe how his organization responds to the new order. In this manner he can gauge how rapidly other improvements can be installed without undue disturbance.

How much is an engineer's opportunity for advancement increased in industry by his obtaining an advanced degree rather than spending that time learning more of his own work?

It depends upon what the engineer's aims or ideas may be. If the engineer feels he is not going to follow the strictly engineering profession, but rather is using it as a background for allied pursuits, he may wish to supplement his engineering degree with a course in business administration or something else. Likewise, if the graduate plans to follow research, it may be desirable to take more advanced courses in that particular branch of science he is going to pursue. Where this is done, advancement should be more rapid at the start. The more we know, the better qualified we always are. To take advanced work, the student should have shown better than average ability in obtaining his academic degree. The average engineer, however, should give weight to beginning his life's work in the outside world upon graduation.

Please define what you mean by the "right" attitude and "right" thing. How is it possible to know beforehand what the "right" thing is? Do you expect all subordinates to conform to the opinions of their superiors so that the superiors think that the subordinates' actions are "right"?

On a strictly moral basis we should intuitively know right from wrong. The questioner, however, quite likely was thinking more in terms of right decisions, versus erroneous conclusions. We will take the questions in order. A right attitude is one that is constructive. A wrong attitude is one that is destructive. A right attitude is positive. A wrong attitude is negative. A right attitude breeds success, contentment, happiness. A wrong attitude fosters failure, discontent, unhappiness. Attitude means how you look at things. A right attitude asks, "How much can I give and share with others?" A wrong attitude says, "How much can I get and take from others?"

We may not always know in advance what is the right thing. That is why we sometimes make mistakes and need to retrace our steps. But a longing desire to do the right thing, to make right decisions, will speed us in the right direction. When in doubt to know what decision is right, it is wise to be patient and allow time to unfold the pros and cons. Subsequent events may

(*Concluded on page* 42)

Alumni News

James C. Rockwell, M.E. '04, who is president of the Manila Electric Company will retire in October. Mr. Rockwell has been president of the company for the last thirty years and has lived in the Philippine Islands for thirty-seven years. During the war he was interned by the Japanese government. After his retirement he will probably return to the States and live in Carmel, California.

Andrew J. Haire, M.E. '05, who is president of the Haire Publishing Company of New York City was elected president of the advertising club of New York last May. For the last three years he has been director and vice-president of the organization. The publisher of eleven trade journals, Haire is also president of The Associated Business Papers and a director of the National Association of Magazine Publishers.

A. Clinton Decker, C.E. '09, was awarded the John M. Diven Memorial Medal at the society's convention in Atlantic City, N. J. May 6. For the last thirty-six years sanitary engineer for the Tennessee Coal, Iron and Railroad Company, Birmingham, Ala., Decker won the award, made each year to the member who has contributed the most outstanding service to the organization, for his work in the field of water purification. He has been an officer of the AWWA water purification division for a number of years and headed a committee which developed a text of the Association's current edition of the Manual of Water Quality and Treatment. From 1932 to 1939 he served on the engineering commission for the Birmingham Industrial Water Works. He is a past president of the Birmingham Engineers' Club.

Howard T. Critchlow, C.E. '10, of the New Jersey Section of the American Water Works Association was one of the recipients of the George W. Fuller Award. He also gave a paper on "Policies and Problems in Controlling Ground Water." Mr. Critchlow is Chief Engineer, Division of Water Supply, State Department of Conservation, Trenton, N. J.

Ralph Brown, M.E. '13, M.M.E. '15, Ph.D. '17, who is the Director of Research at Bell Telephone Laboratories, has been named to receive the annual Medal of Honor awarded by the Institute of Radio Engineers. The medal was awarded "in recognition of distinguished service rendered through substantial and important advancement in the science and art of radio communication." It will be presented at the Institute's convention in March, 1949.

Ralph Brown

Dr. Brown's work, concerned with various aspects of radio broadcasting and ship-to-shore and overseas telephony, has brought him an international reputation in the communications field. He served as President of the Institute of Radio Engineers in 1926, and in that year received the Institute's Morris Liebman prize for his distinguished research on wave transmission phenomena.

After service as a captain in the Signal Corps in World War I, he joined the Development and Research Department of the American Telephone Company, which in 1934 became part of the Bell Telephone Laboratories.

As a division member and consultant of the National Defense Research Committee, Dr. Brown specialized in radar, and in 1941 was sent to England by the U.S. Government to study radar operations under combat conditions. He also served as expert consultant to the Secretary of War. At present he is serving on the Joint Technical Advisory Committee of the Radio Manufacturers Association and the I.R.E. Dr. Brown is the author of numerous technical papers and holds many patents relating to radio and telephone communication.

Rudolph L. Cullum, M.E. '15, has been made district manager of the Turner Construction Company in Chicago, Illinois. Mr. Cullum was formerly located in New York at this company's office.

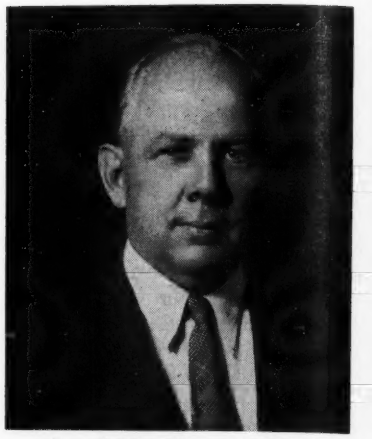
At the Annual Meeting of the American Water Works Association held at Atlantic City, N. J., during the week ending May 7, a paper on "Making Friends With The Customer" was presented by **Ellsworth L. Filby, C.E. '17.** Mr. Filby is at present a member of Black and Veatch, Consulting Engineers, Kansas City, Mo. **Dean Edward R. Stapley, C.E. '14, M.C.E. '30,** of the Oklahoma A. and M. College at Stillwater, Okla., took part in a panel discussion devoted to "Water Works Schools and Conferences."

William B. Gregory, M.E. '23, was promoted to manager of the Dallas, Tex., office of the A. M.

(*Concluded on page* 30)

Cornell Society of Engineers

107 EAST 48TH STREET 1948-1949 NEW YORK 17, N. Y.



Creed W. Fulton, M.E. '09

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University its graduates and former students and to establish a closer relationship between the college and the alumni."

Today's Challenge

Never in its history has our country faced more complex or critical problems than today.

Never has the impact of technological developments on our social order been more apparent or portentous.

Never has there been a greater need for wisdom, courage and enlightened leadership.

In the past Cornell has accepted every challenge, risen to every occasion and met every test. Today, however, we face a situation without parallel in all our previous history. We are seriously challenged in several directions. Cornell's reputation imposes the obligation of meeting today's challenge.

As Cornell engineers our immediate concern is the challenge to our College of Engineering. We surely contribute to the good of Cornell as a whole by making our own College strong.

Your Society has for many years worked in the interest of the College of Engineering and its alumni. It has done a good job. But we have felt for sometime that today's challenge demands a higher degree of organization than ever before.

For our College of Engineering to continue to pioneer and to lead in meeting the problems of this atomic age requires us to marshall all our manpower inside and out, and mold it into an unbeatable team. To that end your Society last year prepared itself by a revision in its constitution and by-laws, which recognized the new factors in today's situation.

Our organization has been broadened by including the Dean of the College as Honorary President, and the Directors of the six engineering schools as Honorary Vice-Presidents. This is not intended as a mere gesture or empty honor, but, rather, as recognition of the important part they can and should play in developing and carrying out a comprehensive plan for achieving our aims and objectives.

Two new standing committees have been added, one on "Advisors to Engineers," the other on "Cornell Engineers in Industry." The aims, objectives, and programs of these committees are now in development.

A significant recent development has been the formulation of a comprehensive program for 1948-49, which I hope and believe will command the interest, respect and support of all Cornell Engineers, and of the entire engineering faculty.

HERE IT IS!

Major Aims

1. To further enhance Cornell's reputation in engineering; specifically in those areas covered by the present schools in the College of Engineering.
2. To create greater regard and acceptance for Cornell engineers over a wider area.
3. To establish a closer relationship between the College and the alumni.

These objectives harmonize with the aims of the College of Engineering under the present administration. They have done a great job, but an even greater job is requird by today's challnge.

It is our privilege to participate in and contribute substantially to the dynamic and comprehensive program for achieving these major aims and objectives.

Here are the specific steps, which we propose to carry out during the current year.

I—Enlist the interest and active cooperation of the three major groups at Ithaca in our program:
- (a) The Dean and the Directors of the six Schools in the College of Engineering.
- (b) The editorial and management staffs of the *Cornell Engineer.*
- (c) The undergraduates.

II—Increase the Society's membership from current 2,800 to at least 4,500 in June 1949. Our ultimate objective should be at least 50% of our engineering alumni—or approximately 8,000. Our past methods of promoting membership, while fairly successful, need to be enlarged and made more aggressive.

III—Help the *Cornell Engineer* become a finer magazine and a more effective tool in forwarding the general aims and objectives of our Society, and of the College of Engineering:

(*Continued on page* 28)

News of the College

Cited for OSRD Services

The President's certificate of merit was presented to five Cornell faculty members for their outstanding services to the wartime Office of Scientific Research and Development. In a joint Army-Navy ceremony Thursday, September 23, at 4:30 p.m. in the Memorial Room of Willard Straight Hall on the campus.

Formerly members of the wartime Office of Scientific Research and Development, they are Dr. Charles Russell Burrows, Director of the School of Electrical Engineering; Dr. Dale Raymond Corson, Dr. John Raven Johnson, Dr. Franklin A. Long, and Dr. John Barkley Rosser.

After an address by Major-Gen. Edward P. Curtis, Reserve, the certificates were presented by Rear-Admiral F. E. Haeberle of the New York Naval Shipyard, Brooklyn, N. Y.

The ceremony was part of a nationwide program honoring scientists and engineers who contributed their services to the armed forces during World War II. A total of 199 certificates will be presented in similar ceremonies this month throughout New York, New Jersey, Delaware, and the New England states, with ranking Army general officers and Navy flag officers officiating.

Soils Engineering Research

A research program in soils engineering was initiated this past summer by five members of the Faculty of the College of Engineering. They are Professors Donald J. Belcher and Raymond D. Lewis, Research Associates Charles H. Ladenheim and Raymond J. Hodge, and several graduate assistants.

The work consisted of analyzing the world's principal land forms, in order to determine what type of structure is best suited for a given area. The results of this investigation will enable nations to select the most efficient construction equipment and methods for irrigation projects, drainage, and transportation systems, and for the development of natural and agricultural resources.

The investigations carried the group to such remote places as Greenland, Alaska, the Aleutians, Europe, and North Africa. The results of these global explorations will be combined with an analysis of aerial photographs to determine the nature of these land forms and the engineering problems they present. Much information may be deduced from the aerial photographs according to Professor Belcher, since different land forms result in characteristic patterns on the photograph.

Several additional graduate fellowships in the soils engineering field will be available at Cornell for the 1948-49 academic year. The soils engineering project is jointly sponsored by Cornell and the Office of Naval Research.

Greater Cornell Fund

A two year financial campaign for $12,500,000 to meet Cornell University's "immediate needs" in faculty salaries, research, and building construction was announced at the close of last semester by President Edmund E. Day.

The College of Engineering is scheduled to receive $2,000,000 of this sum, in order to add another unit to the proposed new engineering quadrangle, of which Olin Hall was the first building.

In other fields of scientific endeavor, another $1,500,000 will be assigned to complete the Laboratory of Nuclear Studies. The building, which is nearing completion on a site overlooking Beebe Lake, "will enable Cornell to play a still more important role in one of the most momentous developments in human affairs," the president said. A complete account of the October 7th dedication ceremonies will appear in next month's CORNELL ENGINEER.

Dr. Hans A. Bethe also told of plans for the new 300,000,000-electron-volt-synchrotron, which will be housed in the new building, while Dean S. C. Hollister traced the history and current progress of the College of Engineering, at this same meeting.

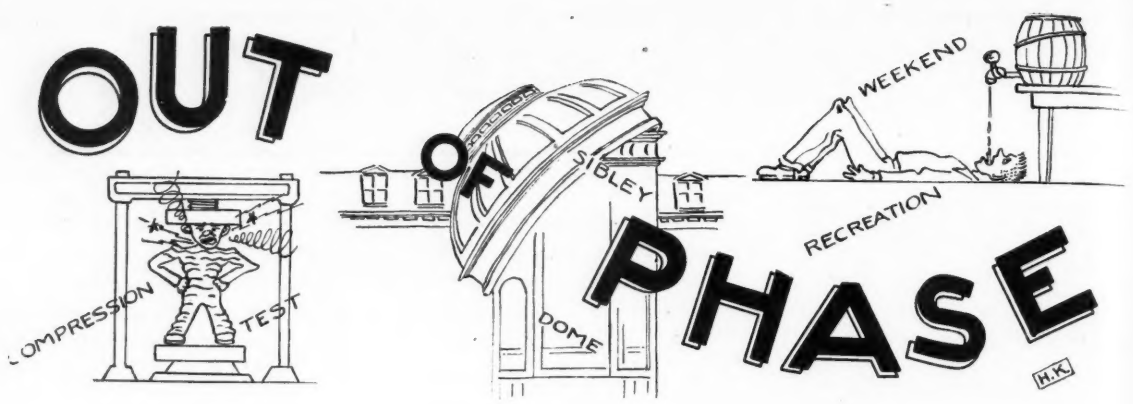
P&G Summer Employment

Richard L. Fairchild, Class of '49, a major in chemical engineering, was one of 50 students chosen from leading engineering colleges all over the country to take part in the 1948 summer employment program of The Proctor and Gamble Company. He worked at the Port Ivory, Staten Island, plant. The summer employment program of Proctor & Gamble is for college students who are to be graduated the following year.

The problems assigned to the summer employee are carefully selected to enable him to see various types of work available in the company's plants and laboratories. Typical of the problems which Fairchild handled were a survey of the electrical load in the laboratory and the determination of the most economical method of handling spent catalyst.

Dick Fairchild

(*Continued on page* 44)



By HERBERT F. SPIRER, EP '51

Despite skillful attempts to hide the occurrence of a meeting at Cornell which was to be of the greatest importance to students of engineering, trained agents of the CORNELL ENGINEER were able to inform us as to the time and place of the meeting with considerable accuracy.

And so, without delay, with the object of always providing you Cornell engineers with the latest and most up to date information about engineering, our most fearless undercover reporter, Eutectic Sitzfliesch was dispatched. His report on the history-making event follows . . .

In order to crash the 75th Semi-Annual Secret Conference of Engineering and Physics Textbook Authors, I disguised myself as a copy of *Hausmann and Slack*. (This may, at first glance, seem to be difficult, but after years of facing such problems as outwitting the chaperones at a house party, and trying to stay alive on $75 per month, it is a minor task.)

"The meeting will come to order," said the lusty voice of Francis Western Burns, newly-elected chairman of the Conference.

"We shall first hear from the Publishers' Representative."

A well-fed individual in a purple-check suit dropped a racing form and leaned forward. He rasped, "Gentlemen, professors, and distinguished laboratory instructors . . On behalf of those noble bulwarks of modern American education . . . education, yes education, in the manner of Aristotle, Timoshenko, and Erskine Caldwell, my employers . . . those great publishers, yes publishers, McGrew Valley, Makamillion, the Kendall Square hucksters, and D. Van Nostrum . . . On behalf of all these I express appreciation to Francis Western Burns for his new series of Physics Textbooks."

"What would any ordinary writer do when a new physics book is called for? He would write a book. *A* book. One chubby little book. But not Burns. He substitutes three thin volumes for one comprehensive volume, and thereby triples the profits."

"And as if this were not enough, he scientifically selects the binding material so that the binding wears out at the end of one term, making resale as a second-hand book impossible."

Much applause followed the commendation. It was obvious that the group considered Burns the unchallenged champion of textbook authors. When the applause subsided, a weak voice was heard from the back of the room.

Beer Mug Hangs from Neck

There I saw, standing unsteadily, a familiar lean figure. It was Prof. Argenfrostle of the Lincoln School for Rodmen. What a change had come over the old boy since the day before when I had visited him at his palatial penthouse atop the University Water Filter Station. Then he had been dressed in the height of Ithaca fashion, seersucker suit, straw hat, and wearing his gold-plated beer mug around his neck on a silver chain.

But today, one day later, he stood before us in rags. His clothes were fashioned of used machine shop waste; on his head he wore an old stocking, and his feet were bare and haggard.

"Mr. Chairman," he coughed, "I wish to request permission to author a new textbook on Materials. My present status of near-poverty makes me eligible, under By-law XLIV, to be the author of such a new publication. The book will, of course, be required equipment for all students taking related courses."

A short debate followed during which Prof. Argenfrostle was required to show his state of financial necessity, which he did cleverly. Twice during the discussion he fainted, ostensibly from lack of food. An approving vote was given despite the existence of fourteen thousand textbooks on the same subject, all of which were patterned after the same work, a compendious volume written in 1512 by an Australian plumber.

The selling price of the new book was then argued. The Steering Committee for the Preservation of Higher, Higher, and Yet Higher Prices for Textbooks recommended an increase of two dollars over any decision that the group made, as a safety factor.

A Professor of Sanitary Engineering questioned, "But won't this make the book out of reach of the poor students?"

(*Continued on page* 38)

Newsworthy Notes for Engineers

Red Light stops trouble-makers

This girl is using a test set designed by Western Electric engineers to detect defective fuses which would pass ordinary tests. X-ray studies of bad fuses showed broken fuse wire as the usual cause of failure, but that 90% of the time, the broken ends made sufficient contact to test O.K. unless the fuse was vibrated. In the new test set, the fuse is struck ten times a second with a force of 250 grams causing the broken ends to separate—an "open" for as little as ten micro seconds, lights a red light—and the fuse gets no chance to make trouble in telephone service.

Bumper crop of crystals grown from seed

Here you see a tank-full of synthetic EDT (ethylene diamine tartrate) crystals ready for harvesting at Western Electric's Electronics Shop. These have been held at a fairly constant temperature for several weeks and have swished back and forth in the solution in the tank, growing from tiny seeds into chunks the size of your fist. They will now be processed into crystal plates to filter various voice channels—nearly 500 separate conversations—traveling over the same long distance telephone circuit. Setting up equipment and working out precise controls required in growing crystals was an interesting problem for Western Electric engineers. This year's crop will produce a million or more crystal plates.

Engineering problems *are many and varied at Western Electric, where manufacturing telephone and radio apparatus for the Bell System is the primary job. Engineers of many kinds—electrical, mechanical, industrial, chemical, metallurgical—are constantly working to devise and improve machines and processes for mass production of highest quality communications equipment.*

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

Prominent Engineers

William Wade

(*Continued from page* 19)

ing in the air, Bill took his final hitch, this one for life, and was married in June, 1946.

Achieving the rate of chief photographer's mate while in the Navy, Bill spent many a carefree and happy moment descending the gorges and climbing the hills to get unusual shots of campus scenes. A favorite snap is the one of his battered, but not beaten, Model A Ford.

Bill is a member of Tau Beta Pi and won the essay contest with his article, "Why Not Cheat?" He is also a member of the Civil Engineering School's honorary societies, Chi Epsilon and Rod and Bob, and takes an active part in A.S.C.E. meetings.

Spending most of the summer months working with construction companies has failed to impress Bill that this should be his life work. Although he says he wants a "stationary" job upon graduation in June, you won't find him sitting in a box at a world series baseball game if there's a good trout stream within 100 miles. Bill believes that more emphasis should be placed on non-competitive sports—swimming, hunting, sailing, and fishing—to provide recreational pastimes which can be followed after graduation "when there isn't a team handy." Take note of this graduating senior's thoughtful words.

The best of luck to you, Bill Wade.

President's Message

(*Continued from page* 24)

(a) By securing outstanding articles on timely and important subjects.
(b) By increased advertising from our alumni and their friends.
(c) By increased circulation.

IV—Increase the number of regional groups in key cities not now covered. Among those which seem promising are: Chicago, Milwaukee, Schenectady, Albany and Troy, Rochester, Buffalo, Pittsburgh, Baltimore, Washington, St. Louis.

V—Activate our regional groups so that they will contribute definitely to achieving our major aims and objectives. This can be done by:

(a) Outstanding meetings aimed primarily to better inform Cornellians and non-Cornellians

(*Concluded on page* 30)

"Energy and persistence conquer all things"—BENJAMIN FRANKLIN

Why power now serves us better

When it comes to *power*, the dreams of our childhood are fast becoming a reality. For no matter what our needs, special motors or engines are now designed to meet them.

From the tiny thumb-sized motors in electric razors—and the surge of the engines in our cars—to the pulsing turbines that propel our ocean liners . . . today's power is better, more dependable than ever before. And these advances were brought about by research and engineering . . . and by today's *better materials.*

Examples? Better metals for giant turbines and generators, improved transformers and transmission lines. Stainless steel, resistant to rust and corrosion. Better plastics that make insulation fire-resistant, and more flexible and wear-proof . . . for the millions of miles of wires it takes to make power our servant.

There is a promise, too, of even greater, more concentrated power. *Atomic* power harnessed for industry and the home . . . approaching man's dreams for the future through research and engineering. This also takes such materials as carbon . . . from which the all-important graphite, used to "control" the splitting atom, is made.

The people of Union Carbide produce materials that help science and industry improve the sources and uses of power . . . to help maintain American leadership in meeting the needs of mankind.

FREE: *You are invited to send for the new illustrated booklet, "Products and Processes," which shows how science and industry use UCC's Alloys, Chemicals, Carbons, Gases and Plastics.*

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ELECTROMET ALLOYS AND METALS • HAYNES STELLITE ALLOYS • PRESTONE AND TREK ANTI-FREEZES • SYNTHETIC ORGANIC CHEMICALS

Alumni News

(*Continued from page 23*)

Lockett & Co., Ltd., following the death of Henry E. Chambers, Jr. M.E. '11. Mr. Gregory has been with the firm for twenty-two years and has been assistant manager of the Dallas office since 1943.

Theodore H. Booth, M.E. '25, of Greensburg, Pa., was appointed vice-president of manufacturing of the Walworth Company.

Howard T. Zimmerman, M.E. '26, is treasurer and chief engineer of the Ralph B. Carter Company in Hackensack, N.J.

Winton Patnode, BChem '26, '27, Ph.D. '31, has been made assistant to the general manager of the nucleonics department of the General Electric Company with headquarters at the Hanford Works, Richland, Wash., which is manufacturing plutonium under contract to the Atomic Energy Commission. Mr. Patnode joined the General Electric Research Laboratory after receiving his Ph.D. here at Cornell. His work has been mainly in the field of silicones and plastics. Last year he was put in charge of the laboratory's branch at the Hanford Works.

Walter C. Knox, C.E. '29, who is civil engineer for the Mobile District, Corps of Engineers, Department of the United States Army, is office engineer on the construction of the Allatoona Dam on the Etowah River in Georgia. Allatoona Dam is a $13,000,000 flood control and power project northeast of Atlanta and at present is about half completed.

Harry H. Almond, B.Chem.E. '46, is now with the law firm of Davis, Hoxie & Faithful, a firm engaged in patent and corporate matters in New York City. Mr. Almond writes that his undergraduate work leading to a B.S. in Chemistry at Yale Sheffield Sceintific School and to a B.Ch.E. in chemical engineering at Cornell should be invaluable in this work.

President's Message

(*Continued from page 28*)

about the outstanding job Cornell is doing in engineering and Cornell engineers are doing in industry.

(b) Local personalized membership effort to help us reach our membership objective.

(c) Assist in carrying out the work of our new committee on "Advisers to Engineering Graduates" and in expanding the scope and effectiveness of our Placement Service.

(d) Work with our new committee on "Cornell Engineers in Industry."

This is an ambitious program. It ought to be carried out. However, it can be carried through successfully only by the whole-hearted interest and supported by every group and individual in our overall set up.

THAT MEANS YOU! Specifically, here is what you can do:

First—Join the Society if you are not already a member;

Second—Obtain at least one new member for the society;

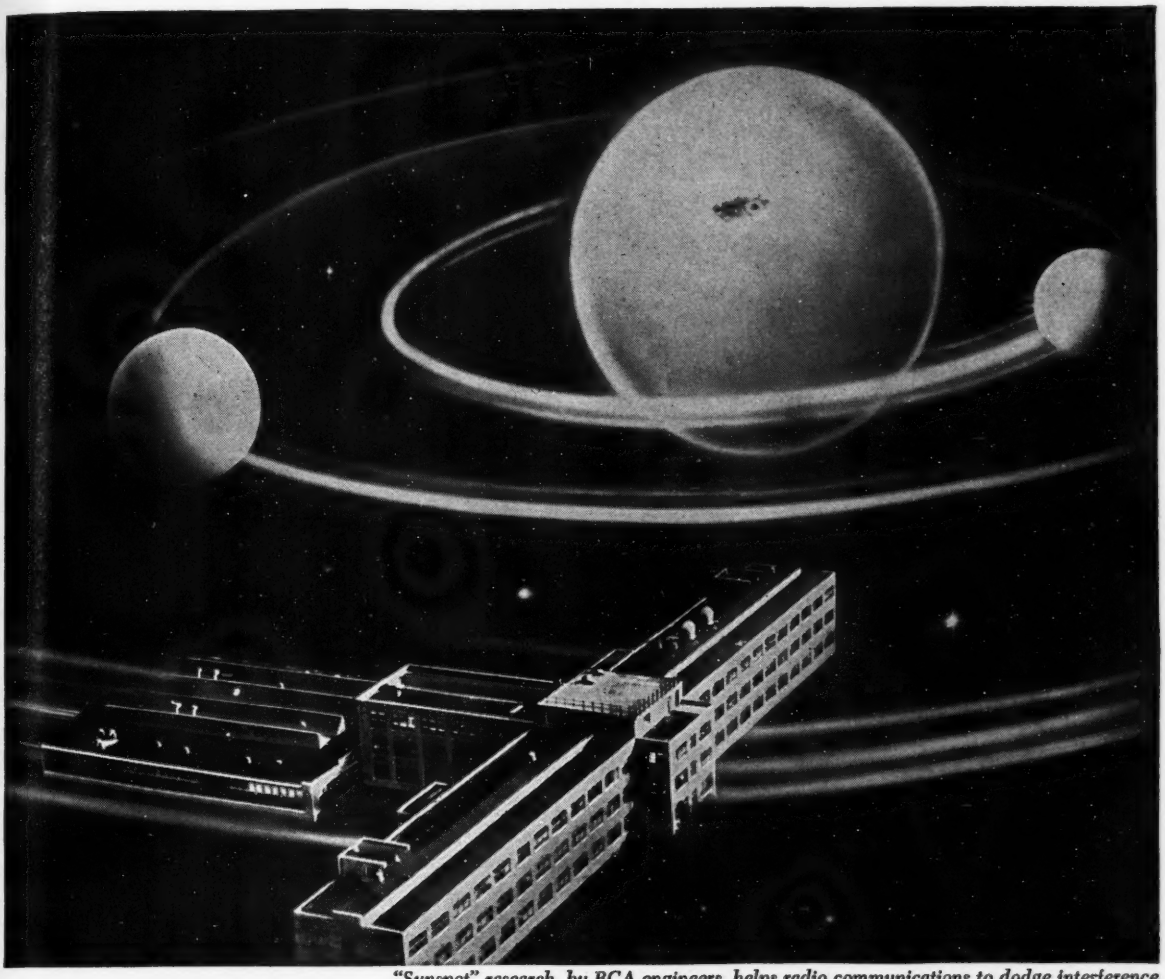
Third—Send us suggestions for bettering our program.

Fourth—Participate actively in the meetings and work of the Society.

There is today's challenge for you, and me ,and all the other 16,000 Cornell Engineers.

How will you meet it?

CREED FULTON



"Sunspot" research, by RCA engineers, helps radio communications to dodge interference from magnetic storms. RCA Laboratories is a center of radio and electronic research.

93,000,000 miles of laboratory space

A cyclonic spot erupts on the face of the sun, and—here on earth—we feel it. Sunspots cause "magnetic storms," which disrupt radio communications.

What can be done about it? Research, during which RCA scientists and engineers "worked" by instrument on the sun—93,000,000 miles away—offers an answer.

For years, science related magnetic storms to sunspots. Accurate forecasts of disturbances were needed.

RCA scientists took a new tack. They noted that interference was most intense when sunspots were in a certain "critical area." Location and activity were observed to be more important than size.

Using this knowledge, RCA communications engineers accurately forecast the beginning and end of magnetic storms. They have established a daily magnetic storm forecasting service which is distributed like weather reports throughout the world. Transmission of messages can be arranged over circuits or paths that will dodge interference.

Such a pioneering spirit in research gives efficiency of service and leadership to all products and services bearing the names RCA, and RCA Victor.

• • •

When in Radio City, New York, be sure to see the radio, television and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission. Radio Corporation of America, RCA Building, Radio City, N. Y. 20.

Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and reproducing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RCA **RADIO CORPORATION of AMERICA**

Luminescence

(*Continued from page* 17)

tained the dark adaption of the pilot's eyes. Phosphorescent paints were also employed to make important signs, stairways, doorways, and so on, visible under blackout conditions. Zinc and cadmium sulfide phosphors had a far brighter initial phosphorescence than calcium or strontium sulfide phosphors, but lacked the persistence of the latter. Other problems involved protection of the phosphor from the effects of weather, keeping phosphor grain size small enough so that a paint could be prepared, and finding a paint vehicle which would not react with the phosphor to destroy its luminescent properties. At present phosphorescent material is available in blue, green, blue-green, or orange-yellow in the form of brush or spray paints; coated papers or textile fabrics; plastic molding granules and powders, sheets, films, or adhesive tapes; printing inks; decalcomanias; silk screen printing paints; and porcelain. Much remains to be done before these materials have more than a novelty value. In the present products, decay of phosphorescence is too rapid and the intensity so low that the eyes must be dark-adapted to see the phosphorescence.

Used In Cathode Ray Tubes

One very important use of fluorescent phosphors is in the cathode ray tube, which is an integral part of television receivers, electron microscopes, and the various types of oscillographs, including the electrocardiograph. The cathode ray tube is essentially a highly evacuated tube having a cathode or negative electrode at one end, a screen coated with a fluorescent phosphor at the other end, and a magnetic lens system to focus the electron beam emitted by the cathode. Many different phosphor types are used depending on the property most desired in the particular use in which the tube is to be put. The television receiver uses a zinc-cadmium sulfide for color and a copper activated zinc sulfide for maximum brightness. A mixture of magnesium tungstate and zinc beryllium silicate may be used to give white. For visual observation in the electron microscope, a copper activated zinc sulfide phosphor is used, but calcium tungstate or silver activated zinc sulfide provide better photographic reproduction.

An interesting application of fluorescence of organic dyes is in tracing circulation in the human body, in animals, and in plants. Another use is in following the courses of underground streams. Fluorescein is the chief dye used in this work because it remains fluorescent in aqueous solution at dilutions below 10^{-8} grams per cubic centimeter. Anthracene in alcohol is fluorescent at the same dilution.

Thus it is that new uses for the phenomenon of luminescence are being conceived daily. With improvements in the quality of luminescent materials and with a supplemented knowledge of the theory of luminescence, what two hundred years ago was a laboratory curiosity promises to become within a few years an accepted part of our way of life.

Another page for **YOUR BEARING NOTEBOOK**

How to keep a power shovel from digging its own grave

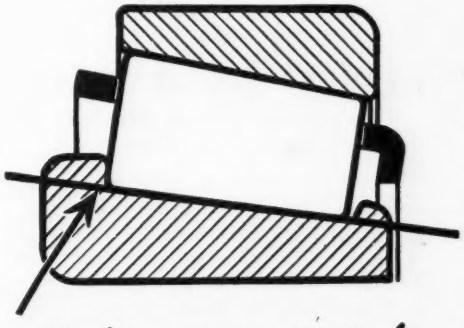
Power shovels and other heavy duty construction equipment take a terrific beating. And this used to wear them out at an early age. Today, engineers are building longer and longer life into the construction equipment they design by specifying Timken tapered roller bearings in place of the friction bearings formerly used.

Timken bearings make parts last longer by eliminating friction, by keeping gears meshing properly and by preventing vibration.

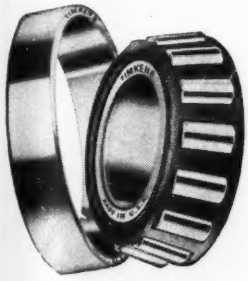
Why Timken bearings are first choice for heavy shock loads

Notice how the load on a Timken bearing is spread over the entire length of the roller instead of being concentrated at a single point. This reduces the unit pressure between the rolling elements.

This greater load area minimizes distortion of the bearing. Load capacity is increased, the bearing wears longer, and wheels and shafts are held rigidly in line. It's another big reason why 9 out of 10 bearing applications can be handled more efficiently with Timken bearings.



line contact provides greater load area



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Would you like to know more about bearings?

Some of the important engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'd be glad to help. For additional information about Timken bearings and how engineers use them, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◎ AND THRUST —◎— LOADS OR ANY COMBINATION ✳

Aircraft Production

(*Continued from page* 14)

fuselage, and all connecting leads into the fuselage are secured. Finally all controls, wiring, and hydraulic tubing which can be tested without running the engine, are checked. The ship has now reached the end of the line; the huge traveling overhead crane picks it up out of the jig and sets it on a ramp, where it is rolled out of the plant for its engine test.

Skilled mechanics run the engine for several hours, carefully checking all instruments and the engine's general behavior. If trouble is discovered, the ship is taken back to the shop where a trouble-shooter squad works on it. When it does pass the engine test, the ship is wheeled to the paint tunnels—large, high-ceilinged rooms noisy with the roar of ventilators and fresh water, which cascades down one wall, picking up most of the paint fumes—and emerges as a sleek, dark blue Bearcat, proudly displaying the white star of the United States, and its Navy unit designation. After it passes its test flight, the Bearcat will be ready to take its place in Uncle Sam's new peacetime Navy; to protect America's interests anywhere in the world.

Profits Despite Lean Year

These are the methods commonly employed in the American aircraft industry today for the production of such planes as are still being ordered by the armed forces, or which can be sold in the very limited post-war civilian market. More economical production, more closely resembling the mechanically-driven assembly line type developed by the automobile industry, is not possible at present because of the pitifully small quantities of aircraft which can now be sold. Despite the rather large amount of hand work employed in the current methods of production, manufacturing costs have been kept low enough to allow at least four aircraft manufacturers to show a profit in this past lean year for the industry, and the high standards of quality traditional with the American airplane builders have not been relaxed.

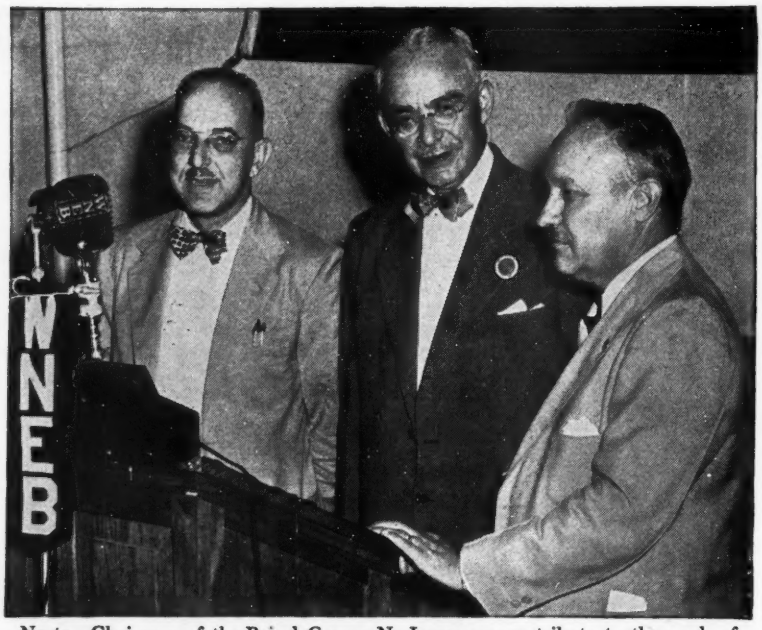
R. R. Modernization

(*Continued from page* 9)

modern streamliners. The sidewalls must be torn down, except for the posts, to make room for new double-width windows of non-fogging glass in stationary metal frames.

As a first step in the dismantling process the car is jacked up and the trucks and underframe removed. These are completely repaired or renewed. Rivets in the exterior sidewalls are removed and welded sheathing applied. Skirting and streamlined vestibule connection are added, and the vestibules get new steps which can be folded up to complete the smooth, streamlined outside contour. The latest improvements in air conditioning and ventilating are installed. New electrical equipment is needed to take care of additional outlets and the increased requirements of air conditioning, fluorescent lighting drinking fountain, radio and the public address system. The electrical wiring of a railway car is very complicated and may have as much

(*Concluded on page* 36)



Norton Chairman of the Board George N. Jeppson pays tribute to the work of development engineers Wallace L. Howe (left) and Edward Van der Pyl (right) for their work in solving countless problems in building and equipping the world's largest grinding wheel plant

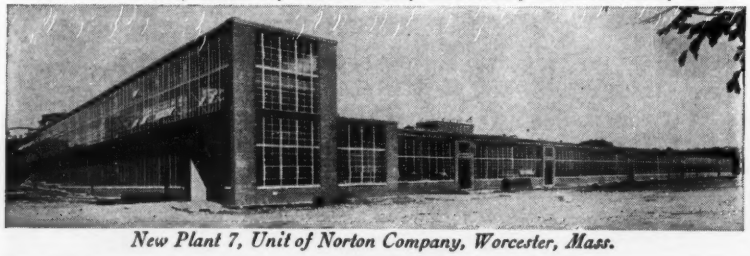
New Era in Grinding Wheel Manufacture

A revolutionary new process in the manufacture of grinding wheels is being carried out in the recently dedicated Norton Plant 7, the largest of the eighty-six buildings that stretch for a distance of one and one-half miles in the Greendale section of Worcester.

In this new Norton plant, with floor space of approximately five acres, grinding wheels are being made at a speed and with a uniformity never before known in the abrasive world.

Abrasive grain and bond, brought in one end of this six hundred and two foot building by a modern conveyor system, moves down the line for various processes, through continuous electric kilns, to finally emerge at the shipping end ready for service in the industrial world.

The new process envisioned through the more than half century experience of George N. Jeppson and the mammoth new building to house it have become realities by the co-operation of Norton engineers—chemical, ceramic, mechanical, electrical, architectural, civil.



New Plant 7, Unit of Norton Company, Worcester, Mass.

NORTON

ABRASIVES — GRINDING WHEELS — GRINDING AND LAPPING MACHINES
REFRACTORIES — POROUS MEDIUMS — NON-SLIP FLOORS — NORBIDE PRODUCTS
LABELING MACHINES (BEHR-MANNING DIVISION) COATED ABRASIVES AND SHARPENING STONES

R. R. Modernization

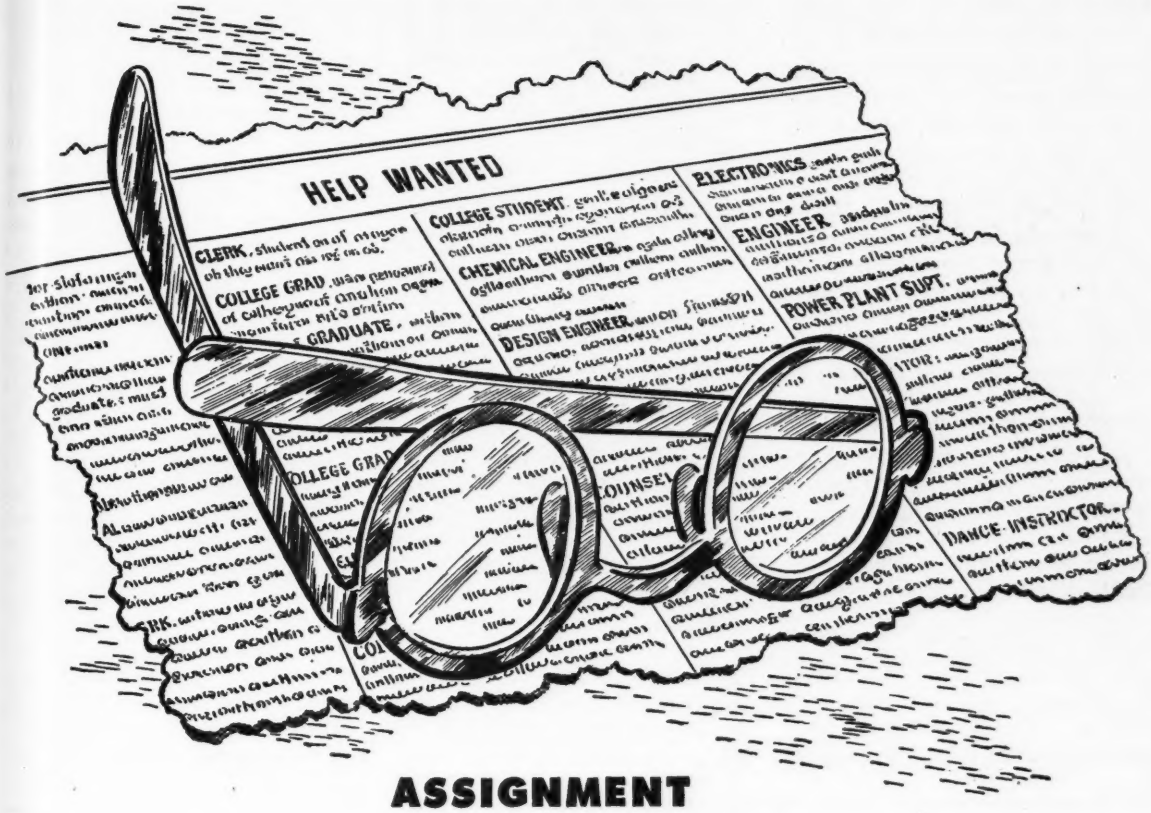
(*Continued from page* 34)

as 16,550 feet of wire of 11 different types and sizes.

The interior furnishings of the car are removed. The old seats are repaired and reupholstered to be used again in some car of lesser rank, probably not operating on a long distance train. The old baggage racks, lights and plumbing fixtures are also repaired and passed down the line. The rebuilt car gets new seats of the most modern and most comfortable type on the market, with reclinable backs fitted to body contours and adjustable footrests to suit different lengths of leg. Seats were not only too high off the floor for the average woman but were not built to support the lower part of the back, because of the requirements of the old method of reversing seats. Insistence that the seat manufacturers do somthing about it resulted in their perfecting, with the aid of our mechanical department, a practical method for revolving the entire double seat instead of just reversing direction with a "walk-over" back.

Woman's Viewpoint

In rebuilding a coach, the partitions of the rooms for men and women are torn out and relocated to make larger dressing rooms with improved facilities and lounge seats. In the latest improved coaches there have been installed many little niceties in the dressing rooms for women. One of the most important is what may be called a "mirror alcove." It took many trial installations to work out a practical plan for including this feature in the limited space available. The distinctive feature of the design is that there are mirrors set at five angles around the occupant of the chair at the vanity table. The one at the back is the most important because it takes the place of the handglass usually necessary to see the back of one's head. This leaves both hands free for inserting hair pins and combs. Only a woman who has trouble with her own hair would be likely to think of such an arrangement. Just another argument for the woman's viewpoint on a railroad!



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HEADQUARTERS FOR TECHNICAL INFORMATION
330 WEST 42nd STREET • NEW YORK 18, NEW YORK

Out of Phase

(*Continued from page* 26)

"Poor Students?" said the Chair, "Poor Students? I thought we eliminated them with the last tuition rise. Well, if there are still a few scrounging around, we will get them with the next increase."

Apparently the determination of the selling price of a textbook is a very complex affair. A pair of dice were brought into the room, and after a short ceremony, the price was announced.

Recommend Impeachment

An excited person wearing sixty or seventy keys on his vest clamored for recognition. He was Prof. Forte, Chairman of the Committee for the Maintenance of Opactiy in Textbooks. In a high falsetto, he proclaimed:

"We recommend for impeachment, on grounds of excessive lucidity, Messrs. Candle and Blots, authors of a treatise on rudimentary calculus. We find them guilty of the following charges:

1. In certain problems of an extremely difficult nature, they stooped so low as to supply hints to the solution,
2. The expressions, 'obviously,' 'evidently,' 'the student may easily see', and 'it follows readily', were used only 1200 times, less than half of the required minimum,
3. The answers to many problems were given in the back of the book instead of being secreted in a separate publication,
4. Certain barely disguised attempts were made to simplify the subject. We include this despite the use of a confusing notation, since they occasionally explained the notation, a practice long condemned."

"Therefore, we find Candle and Blots subject to expulsion from Local 62 of the Union of Textbook Authors, in order to prevent any subversive recurrence of clarity in elementary textbooks."

An electrifying silence followed this announcement, Then, the accused authors rose and chanted in unison, "We, in turn, wish to request the expulsion of the Chairman of the Committee for the Maintenance of Opacity in Textbooks, Professor Forte. In his book, *Basic Basic Engineering*, he has been vague and rambling enough, but we think that he has overstepped the bounds of wisdom. He has been confusing without being subtle."

"He has used analogies that were not merely difficult to follow, as best tradition dictates, but that were plain ridiculous. Oh, his sentences have been misleading, and his proofs illogical, and his problems wonderfully ambiguous, but he does not confuse delicately."

The accused Prof. Forte rose to his feet, the livid scar across his cheek flashing purple with rage. "I would answer these complaints by bringing to your attention the conditions under which I wrote this book. It was in wartime, and I

(*Concluded on page* 40)

Techni-Briefs

Humidity Test Apparatus

(*Continued from page* 20)

While particularly suited for the investigation and calibraton of hygrometers, psychrometers, and development apparatus at temperatures below 0°C, the humidity test equipment may find further application in general research and testing where air of a known low dewpoint or moisture content is desired. With such apparatus, devices placed in the test chamber can be subjected to discrete and almost instantaneous changes in relative humidity. Lag studies may be easily made. The velocity of the air passing through the test chamber can be adjusted to any value up to 1500 ft./min.

Although this instrument was designed primarily to fill a basic need in meteorology, the refrigeration and air conditioning industries may also find it useful. In all these fields, humidity plays an important role. With this equipment, it is now possible to calibrate readily and accurately the varous humidity measuring instruments employed at low temperatures.

Astro-dome

To help ease the job of a navigator of long range flights, Bausch and Lomb Optical Company has designed a new type astro-dome. It is suitable for both military and commercial airplanes. Although the old style astro-domes projected six inches beyond the fuselage, this latest development projects outward only two and a half inches. The decrease in air resistance offered by the new astro-dome should enable aircraft to obtain somewhat greater speeds.

This new window to the sky consists of two streamlined plates of glass. The outer plate is a large optical lens that has been ground and polished to reduce refraction errors regardless of the angle at which the sextant is held. The inner plate is plastic and contains a defrosting system to keep the astro-dome clear.

Out of Phase

(*Continued from page* 38)

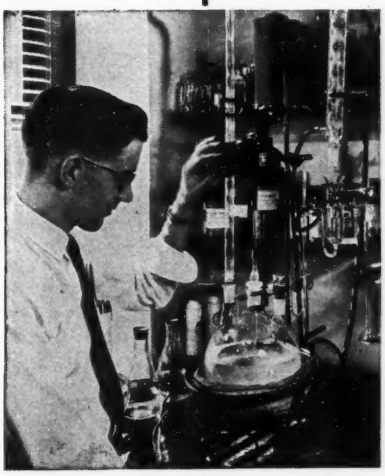
wrote the book during two ten-minute breaks, and read the proofs while lecturing two classes simultaneously. There is, however, an even more important factor. At the time the book was printed, the publishers were rushed, and where any outstanding examples of clearness, or practical problems appear, it is probably a typographical error. I see no reason for changing the book . . . One minute, gentlemen, there is a spy in here! That copy of *Hausmann and Slack* has just sneezed!"

Haven't Been Intimidated

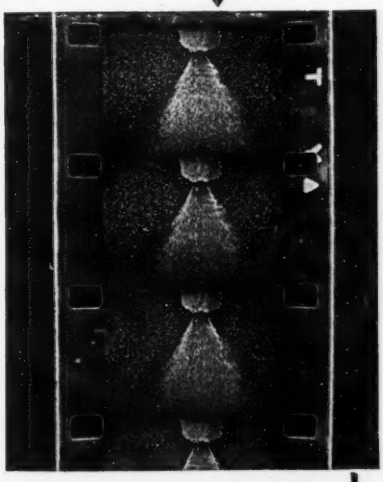
As he pointed a hairy finger at me, I realized the game was up. I dived through the window followed by several howling Professors Emeritus. By running into the basement, I was able to hide for several days, imitating a statue of General Custer's horse. Since it became known that a report of the meeting was to be released, several attempts on my life have been made. We have not been intimidated!

"Flow Chart" of Procter & Gamble Teamwork

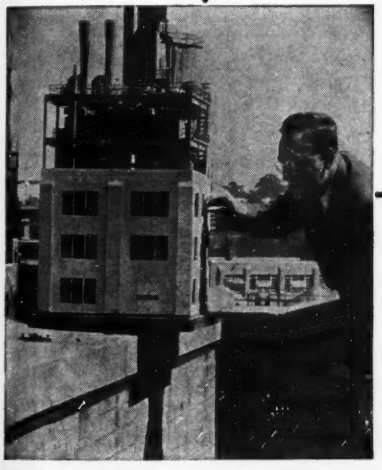
How the skills of many specialists develop a new synthetic detergent . . .



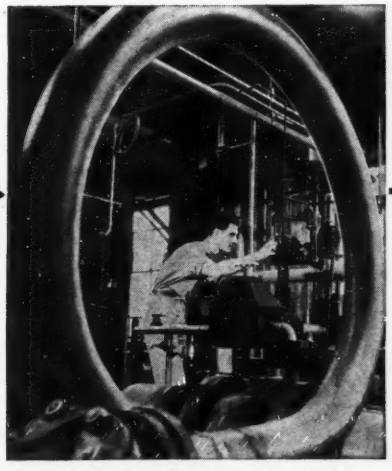
Chemists work in uncharted fields on reactions and formulae in Procter & Gamble's Research Laboratories.



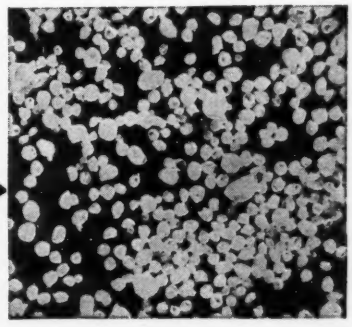
Chemical Engineers use high-speed motion picture photography to study proper nozzle design.



Mechanical Engineers study a 1/32 size model to help translate laboratory processes into reality.



Industrial Engineers face and solve interesting new problems when the finished plant goes into operation.



Result:
A new synthetic detergent

(magnified to show nature of hollow spherical particle)

This is just one example of P & G technical teamwork in action; similar developments progressing in other fields call for additional men with technical training. That's why P & G representatives periodically visit the country's top technical schools to interview students. If you would like to talk to a Procter & Gamble representative, ask your faculty adviser or placement bureau to arrange a meeting.

PROCTER & GAMBLE

CINCINNATI 1, OHIO

Competitive Environment

(*Continued from page* 22)

shed further light on the problems. By keeping our minds open, and free from prejudice and self will, the right way will often be revealed.

Everyone is entitled to his own opinion. If you differ with the opinions of your superiors that is your prerogative, but does not prove you are right and your superiors wrong. Your superiors may have knowledge of facts and conditions not known to you. Be sure you have full information before you pass judgment. On the other hand, your superiors may be pursuing a policy detrimental to the company's interest. Obviously, you do not have to subscribe to such policy. Your position in such a case may become awkward or embarrassing and may lead you to decide to part company. Before doing so make sure your ideas or opinions are pretty sound and that you are not passing up an opportunity. That opportunity may lie in your ability to tactfully and constructively present your views and solutions to some member of management. It could be your big chance.

College News

(*Continued from page 25*)

As a result of this summer experience, Fairchild has an insight into the operation of a large company, a better idea as to the exact type of work he wants to start in, and a better knowledge of The Proctor & Gamble Company's operations. Furthermore, the Company has a chance to size up the individual with a view of offering him permanent employment after graduation.

Win "Arc Welding" Prizes

Leo J. Murphy, ME '48, and Robert H. Staplin, ME '49, have received word that their respective papers dealing with arc welding design were among the seventy-one award winners in the annual Lincoln Arc Welding Foundation's Engineering Award and Scholarship Program. Murphy's paper on the "Arbor Press Frame" won him a cash award of $103, and the paper by Staplin, "An Arc Welded Barrel Cam" brought him a prize of $25.

Prof. Scofield Retires

Following the end of the spring term, Professor Herbert H. Scofield, professor of engineering materials in civil engineering since 1922, retired from the faculty and was subsequently appointed professor emeritus by President Day. Prof. Scofield received his M.E. degree at Cornell in 1905 and taught at Purdue for the next 13 years. He returned to Cornell in 1919 as an assistant professor.

Awarded Physics Fellowship

Paul V. C. Hough, graduate student in Physics, has been awarded the 1948-49 Eastman Kodak Fellowship in Physics, which carries a stipend of $1500. The fellowship was awarded on the basis of the recipient's ability in his chosen field and is for the stimulation of scientific research.

Cornell Aero Lab

The Cornell Aeronautical Laboratory, Inc., has liquidated its last financial obligation to Cornell University and is now operating on a completely self-sustaining basis.

T. P. Wright, President of the Company, announced today that the laboratory has repaid the $250,000 balance of $350,000 borrowed from the University to meet initial expenses and capital requirements involved in placing the laboratory in full-scale operation.

Mr. Wright said that repayment of the loan means that the laboratory, recently established as a special corporate entity, is now on a self-sustaining basis and is not utilizing endowment funds or other resources of the University.

The laboratory was presented to Cornell by the Curtiss-Wright Corporation in 1936. Seven other large east-coast aircraft manufacturers generously contributed capital to assist in its initial establishment. Initially operated by the Univer-

(*Concluded on page 46*)

DU PONT Digest
For Students of Science and Engineering

They said, "You can't do it!"

But Du Pont scientists developed a synthetic rubber with superior properties

"Synthetic rubber is an impossibility at any price!" declared a noted European scientist a number of years ago. And most people were inclined to agree because for more than a century chemists had been unable to duplicate natural rubber.

Du Pont scientists knew that all rubber had bad qualities as well as good. "Why struggle to duplicate its faults?" they asked. "Why not find a new chemical compound with all the good qualities of rubber, but none of the bad?"

They took as their starting point a discovery by Dr. J. A. Nieuwland of Notre Dame in connection with the polymerization of acetylene. By modifying this process, they made monovinyl acetylene. Adding hydrogen chloride, they made a new chemical compound called chloroprene—a thin, clear liquid at low temperatures. Like isoprene, it polymerized to form a rubber-like substance. But the new material, now known as *neoprene*, required no sulfur for vulcanization and was superior to rubber under many service conditions.

Today neoprene production is measured in millions of pounds a year, even though it is priced higher than natural rubber. Hardly an industry is not now using it, for such good reasons as these: neoprene products resist deterioration by oils and greases. They stand up under exposure to direct sunlight. Their aging and flame-retarding properties also are superior to those of rubber.

Three types of Du Pont research

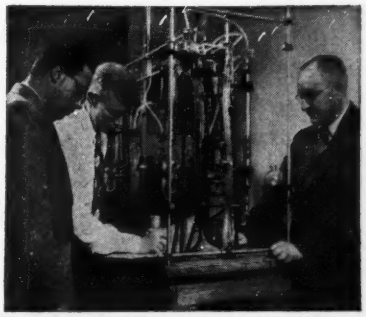
Modern research involves time, money, manpower. To develop neoprene, for example, took six years of laboratory study, a research and development expenditure of millions of dollars, plus the work of skilled research chemists, physicists, engineers, and other scientists.

At Du Pont, research is continuous. Some of it is designed to develop new products or processes; some to improve existing products or processes; and the balance is fundamental research to uncover basic facts without regard to immediate commercial use. Each of ten manufacturing departments has its own research staff and is operated much like a separate company. In addition, the Chemical and Engineering Departments, which are not engaged in manufacturing operations, conduct research in the interests of the Company as a whole.

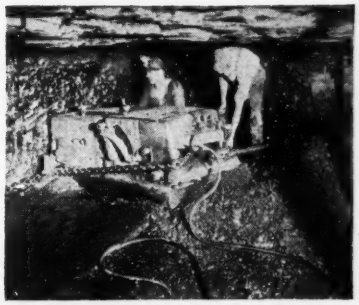
A typical Du Pont research team may include physicists, chemists, chemical and mechanical engineers, each of whom brings specialized training to bear on a specific phase of the subject. The man who joins one of these teams finds himself associated with some of the ab'est minds in the profession and receives the opportunity and friendly support needed to make fullest use of his capabilities.

What you want to know about Du Pont and the College Graduate

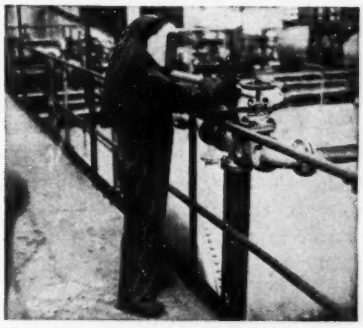
"The Du Pont Company and the College Graduate"—newly revised, fully illustrated—describes opportunities for men and women in research, production, sales and many other fields. Explains how individual ability is recognized and rewarded under the group system of operation. For your free copy, address: 2521 Nemours Building, Wilmington 98, Del.



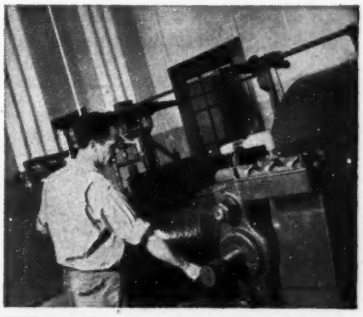
The new research man *has frequent contact with experienced supervisors. Here M. Hayek, Ph. D., Indiana '47, discusses data obtained in an experiment with F. B. Downing, left, a member of research supervision, and M. B. Sturgis, a research group head.*



Neoprene, *used in wire, cable and hose jackets, resists abrasion, oil, heat, and sunlight.*



Neoprene gloves *and protective clothing resist deterioration by chemicals, greases and oils.*



Milling and compounding *neoprene in the rubber experimental laboratory.*

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

More facts about Du Pont — Listen to "Cavalcade of America" Monday Nights, NBC Coast to Coast

College News

(*Continued from page 44*)

sity through the Cornell Research Foundation, it was incorporated in March and now functions as an autonomous unit with all capital stock held by the University. A Board of Directors of fourteen men representing the University, the laboratory staff, and the Buffalo locality overlooks the operation.

The laboratory, capitalized at about four and a half million, and including an 8½ by 12 foot variable density high-speed wind tunnel, operates in all fields of aeronautical research on a non-profit basis. Funds from fees are used for fundamental research or for new equipment. Employing some 600 persons under the direction of Dr. C. C. Furnass, the laboratory is engaged mainly in research for the government.

Honoraries and Societies

Chi Epsilon

Chi Epsilon, the honorary Civil Engineering society for undergraduate students, held its first meeting September 30 in Lincoln Hall. This was in the nature of an organizational meeting. Issues tentatively decided were the continuation of publication of the *Lincoln Log* and the awarding of a prize to the freshman in the Civil Engineering school attaining the highest average.

Pi Omicron

Pi Omicron, National Honorary for Women in Engineering, held its first informal meeting on Sunday, October 10. Its purpose was to acquaint the Freshman Women Engineers with the rest of the engineering women on campus. The new co-ed engineers are: Marie Dimino EE, Luz Cruz, ChE, Marilyn Vaupel, EE, and Lillian Heffernan, EP.

AIEE

The student branch of the American Institute of Electrical Engineers met on October 15 and launched its program for the coming year. The meeting was in conjunction with the parent Ithaca section. The following new officers were installed at this meeting: Norman McIver, President; Bob Watson, Vice-President; and Howie Lemelson, Secretary. After the meeting, the student members, together with the senior members of the Ithaca section, were invited to visit the micro-wave project at the Ithaca Airport.

ASME

The Cornell Student Branch of the American Society of Mechanical Engineers, having installed its newly elected officers, Frank W. Kinsman, Chairman, George D. Russell, Vice-Chairman, and Walter S. Crone, Secretary, has been busily at work preparing an interesting program for the coming school year. The lecture series formally got under way on October 5 when Professor Dexter Kimball, former Dean of the College of Engineering, and past President of the Society of Mechanical Engineers, returned to the campus to speak before the student engineers in Sibley Hall.

The Miracle

you put on your eggs...

Just plain Salt! But what wonders it performs in the hands of expert chemists and engineers. Its two components play a big part in the production of paper, soap, glue, metals, metal products, textiles, insecticides. They help to sanitize water, launder clothing, kill bacteria in dairies, restaurants, food plants.

"Miracle-working" with Salt—as well as other basic chemicals—has been Pennsalt's business for 98 years. Starting with a modest plant at Natrona, Pa., Pennsalt has steadily grown, until today it stands as one of America's important chemical companies.

Big? Yes . . . but not so big as to swallow up its promising young men. Old? Yes . . . but not too old to adopt young ideas that are sound. Pennsalt was founded by a young man; and grew large through the efforts of young men.

The future, too, looks bright for Pennsalt . . . and for the young men who are going to build it. Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

PENN SALT

CHEMICALS

STRESS and STRAIN...

The shabbily-dressed down-and-out panhandler approached the obviously well-to-do man walking down the street and asked him for a dollar to buy a meal.

"Why don't you go to the Settlement House and get a free meal?", he was asked.

The bum looked downcast.

"Golly," he whined, "don't you ever like to eat out?"

* * *

Soph: "They tell me he gives a well rounded course in thermodynamics."

Senior: "That's right. Everything not given during the semester is included in the final examination."

* * *

A kiss that speaks volumes is seldom a first edition.

Matron: "You know I really suspect my husband has a love affair with his stenographer."

Maid: "I don't believe it, Ma'am. You're just trying to make me jealous."

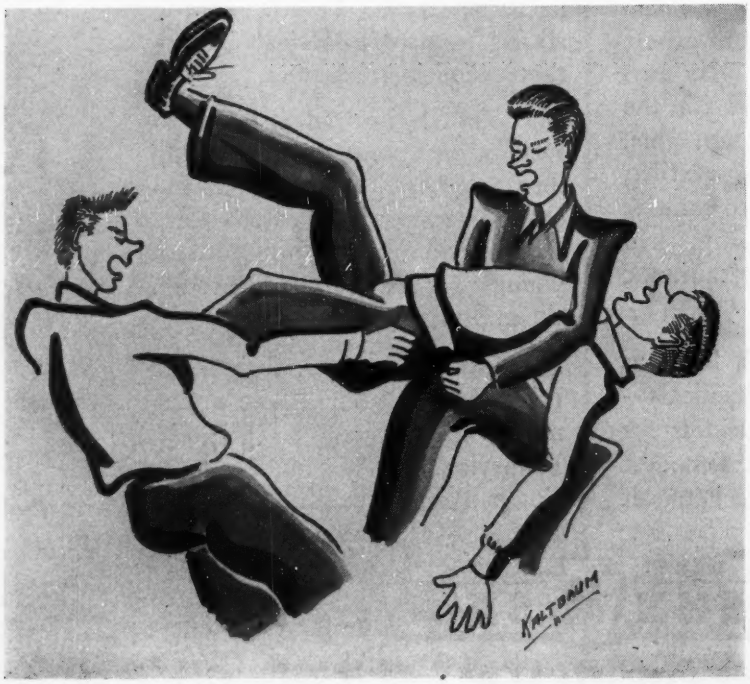
* * *

An engineer dining in a very swanky restaurant finally finished his dinner and the waiter brought him a fingerbowl. A few moments later the waiter was horrified to see him washing a spoon in the fingerbowl. Calling the manager they both hurried to the engineer's table.

"What's the matter here," asked the manager. "Why on earth are you washing your spoon in the fingerbowl?"

"Well," replied the engineer with a scowl, "do you think I want to get ice cream all over my pocket!"

Negotiating for the services of a frosh compet.



Medical Student: "I want to change the death certificate I gave you yesterday."

Professor: "What's wrong?"

Student: "I signed my own name in the space marked cause of death."

* * *

Engineering is a good deal like golf. The good drivers become managing executives. For those whose best shots are brassie, advertising offers a good field in case of a good lie. Those who approach well find salvation in salesmanship. Those who are good on the green become cashiers and investment brokers. But duffers remain engineers.

* * *

A proud mother walked into the "Small Monthly Payments" store clutching a small payment.

"There," she said as she threw it on the counter, "that's the last one on our baby carriage."

"And how is the baby?" asked the friendly clerk.

"Fine, fine," said she, "she's getting married next week."

* * *

In a quiz given History students recently, one of the questions was:

"Name two ancient sports."

A freshman wrote:

"Anthony and Cleopatra."

* * *

A justice of the peace in a small town was called upon to perform his first marriage ceremony. After he had the knot safely tied, the young couple continued to stand before him as if expecting some further rite.

Whereupon the justice stammered out, in a desperate attempt to round off the ceremony with something of a religious turn, "There, there, it's all over! Go, and sin no more."